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ABSTRACT

Newsletter issues pertaining to Lehigh University's Humanities Perspectives on Technology (HPT) Program, which was renamed the Science, Technology and Society Program, are presented. Additionally, a newsletter article excerpt entitled "Elements of Technology in a Liberal Education" is included. Two 1977 issues of "HRP News," five 1978 issues and three 1979 issues of "Humanities Perspectives on Technology," a curriculum newsletter, and two 1979 issues and four 1980 issues of "Science, Technology & Society," a curriculum newsletter, are presented. Specific topics covered in the newsletter include the following: the teaching of science fiction; world futures studies; a course in technology and human values; the views of Jacques Ellul; approaches to teaching history, literature, and technology; an interdisciplinary program in technology, values, and society; an engineering course on the cultural impact of technology; technology and the theory of the humanities; a course in science, technology, literature, and the arts; a course that examines social concerns and human values in an engineering context; behavior control and human values; Christian responsibility for technology; technology, freedom, and individual autonomy; a course on philosophy and technology; a course on technology and environment; product design and ethics; science and technology in the public administration curriculum; technological change and urban policy; the moral dilemma of the scientist; college and museum collaboration; the engineer's role in technological growth; and a course in politics and the 21st century. Course syllabi, book reviews and lists of recent publications are included. (SW)

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HUMANITIES PERSPECTIVES ON TECHNOLOGY PROGRAMS: SCIENCE, TECHNOLOGY AND SOCIETY PROGRAM

LEHIGH UNIVERSITY 1977-80.

Stephen H. Cutcliffe, Editor

HE 013 690

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Excerpted from STS Newsletter, No. 20,
November 1980

ELEMENTS OF TECHNOLOGY IN A LIBERAL EDUCATION

1980 marks the end of a decade of steadily increasing interest in the interactions among science, technology, and society, an interest that has come to define the STS field. To date, there are over 200 formal academic programs and at least an equal number of informal course clusters serving this area of interest at every level of higher education programming. Concurrently, an increasing number of journals and newsletters, among them this one, have come forth to service these programs, providing an outlet for research activity and information dissemination. In spite of this steady growth, it remains the case that the majority of STS courses are located within liberal arts colleges or in the humanities and social science departments of engineering institutions. While these courses provide valuable humanistic and social science interpretations, both of the roles played by science and technology in shaping contemporary society and of the roles played by social institutions in shaping the directions of scientific research and technological development, very few directly address the issue of technological "literacy". That is, few STS courses seek to present the central elements of engineering; seek to explore in detail the distinction between technology as a social process and the technical problem-solving activity called engineering that is embedded in that process, by starting from an analysis of engineering concepts and engineering techniques. Such an approach is especially important for the non-science/engineering student in today's high-technology society. In this sense, 1980 also marks the opening of a new decade of opportunity for STS curriculum development focused on the elements of engineering.

Lehigh University has developed an extensive STS curriculum during the past decade, but like most other institutions, the majority of our courses are taught by humanities and social science faculty. Although we have long had the intellectual support of our College of Engineering and Physical Sciences, this has normally taken the form of guest lecturing and of service as resource personnel for humanist and social science faculty, rather than full-time teaching of STS courses by engineering faculty. Perceiving this as an increasingly serious gap in our own STS Program, we sought external assistance for the development of a package of new courses that would be taught by senior science and engineering faculty.

In May, the National Science Foundation's Comprehensive Assistance to Undergraduate Science Education (CAUSE) Program awarded Lehigh a $240,000 grant in support of a three-year project to develop six new courses designed with a view to providing students who do not plan on majoring in science or engineering a means of becoming familiar with the basic elements of engineering and of its incorporation into modern high-technology society. A separate "gateway" course, not funded under the CAUSE grant, entitled *Introduction to Technology* is presently being developed by Dr. Adrian Richards (Professor in the Departments of Civil Engineering and Geological Sciences and Co-director of the project). This course will provide liberal arts and business students with an understanding of the unique and complementary elements of engineering without using mathematics. Emphasis will be placed on showing how engineering provides technological solutions to problems in a high-technology society, while at the same time being constrained by societal parameters, e.g., economic, legal-political, or moral constraints. This course is planned to serve as an integrative function for the more specialized courses to be developed with the NSF CAUSE support.

At this point, four of the six faculty for the NSF project have been identified. Dr. Alan W. Pense, Professor of Metallurgy and Materials Engineering, will offer a course entitled *The Regulation of Public Safety*. It will trace the growth of regulation for public safety in three intensively technological industries: boiler and pressure vessel construction, bridge construction, and nuclear power and power plant construction. An engineering background will not be assumed, and the elements of mechanics and strength of materials necessary to understand the nature of the regulations discussed will be an early topic of the course. It is intended that the approach will be sufficiently quantitative that the student can calculate margins of safety and can determine the engineering choices to be made in appropriately simple cases. Such calculations will supplement the conceptual parts of the course and will be designed to show the extent to which quantitative solutions to complex problems can and cannot be used as a subsitute for subjective value judgements.

Dr. Ned Heindel, Professor of Chemistry, will offer *Chemistry for the Consumer*, a course that would treat such socially significant chemical issues as the use of food additives, licensing and manufacture of drugs, plastics, paints, and the chemistry of future energy sources. The topics treated will be used as means to excite student interest in chemical concepts. For example, detergents offer an ideal vehicle for teaching the relationship between chemical structure - bonding type - and chemical properties. In this way chemistry and its laws may be related to important societal problems, "painlessly" instruction the student in both.

A third course, entitled *Urban Design and the Skyscraper*, will be offered by Dr. Lynn Beedle, Professor of Civil Engineering. The objective of the course will be to present the parameters that affect the decision making, the planning, the design, the construction, and the operation of tall buildings, considered as systems that bring together many disciplines within and outside of engineering. The course will present to the students the primary professional tools available to, and commonly used by, the various engineering specialties involved in tall building design within the total urban context.

Dr. William E. Schiesser, Professor of Chemical Engineering, will offer the fourth course, *Modeling and Simulation of Socio-Economic Technological Systems Using Computers*. The course will have as its principal objectives an introduction to: (1) the formulation of mathematical models for complex socio-economic-technological (SET) systems; (2) the details of programming of SET models in a standard computer language; and (3) the execution of the model programs to gain insight into the behavior of the SET systems. An emphasis on both quantitative modeling and underlying qualitative judgements will be facilitated by concentrating on problem areas which are currently of major interest and will probably remain important throughout the working careers of present day students, e.g., energy, pollution, natural resource depletion.

Proposals for two additional courses are currently being sought from Lehigh faculty. Although no final decision has yet been made, plausible topics include industrial robots, space engineering, energy technology, and medical research. The package of new courses will be integrated into Lehigh's Science, Technology and Society Program whose Director, Dr. Steven L. Goldman, is Project Director for the grant.

This set of seven courses, one general and six specific, will offer students, especially those not planning to major in science or engineering fields, an opportunity to acquire an understanding of the fundamental elements of engineering. At the same time, those science and engineering students who take the courses will benefit from a clearer understanding of the social context of their disciplines. The challenge as well as the excitement of the project lies in the necessity of developing courses which teach substantive technical concepts in a qualitative manner so that they are understandable to the non-quantitatively-oriented liberal arts student.

In conjunction with the course development phase of the project, Lehigh will sponsor a national conference on the fundamental elements of engineering and how they might best be taught to non-science majors in a qualitative manner. The director of this conference will be Dr. Richards. It is hoped that the papers presented at this conference would define a suitable text for the introductory course currently being developed. At the close of the three year grant period, Lehigh will hold a second conference for the purpose of disseminating to other academic institutions the results of the overall project.

Further information about the CAUSE project, the conferences, or the STS Program can be obtained by writing to: STS Office, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015 or by calling (215)-861-3350. *S.H.C., editor.*

HPT news

Newsletter of the Lehigh University Humanities Perspectives on Technology Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 3
December 1977

THE "TWO-CULTURES" SPLIT AND THE SCIENCE FICTION COURSE

This essay began with a minor incident which occurred last summer. At the end of the first session of a science fiction course I teach, one of my 100 students detached himself from the mass of unfamiliar faces and made an appointment with me to discuss his personal goals in the course. Since I had spent a considerable portion of the preceding hour urging the students to visit me in my office as the only effective way of receiving personal attention in a class of that size, I considered the event a good omen. But the conference turned out to have more substance than I expected. It came to epitomize for me the difficulties involved in teaching a beginning humanities course in a university which does not have a program for bringing the sciences and humanities together, and it reaffirmed my sense of the need for such a program.

The student who came to my office on the first day of class turned out to be a senior majoring in engineering, the winner of several undergraduate scholarships and prizes and the recipient of a fellowship in a first-rate graduate program. He was articulate, personable, and obviously intelligent. He told me that he had decided to take a sophomore course in science fiction because, as he put it, "I want to see how you humanities people think and feel before I enter graduate engineering. This is your chance to convert me."

Conversion is not really my style. I prefer to leave it to reformed politicians. Even if it were a suppressed goal my chances of accomplishing it in a one quarter course in science fiction would be negligible. But I was curious as to why this student thought those of us in the humanities dealt in conversion and why he viewed himself as a potential candidate. I was also intrigued and somewhat disconcerted by the growing realization that this student intended to study me much as humans in science fiction novels study alien cultures. Suddenly I found myself transformed into a specimen of the sub-species "humanist," and I could not help wondering whether my class and I would prove a worthy example of humanistic endeavor.

I wondered more seriously, however, how this student came to view those of us in the humanities as so alien to him that the only avenues of approach to us were either scientific study or conversion. After all, the only things separating us were a few years of specialized education. In the course of a lengthy conversation he explained the source of his alienation from the humanities. For this engineering student the world was a bright, clear, rational, simple place. He found pleasure in doing his work well, in using his mind and talents to succeed in his field, and it seemed self-evident to him that this was a sufficient justification for existence. No other values were really necessary. As far as personal relationships were concerned, he was firmly convinced that his feelings were as much under his rational control as any of the projects he designed. If a relationship went badly, you simply terminated it and began a new one. In short, human beings were rational creatures who designed their lives to achieve as much self-satisfaction and avoid as much pain as possible. Naturally this student found the humanities' obsession with emotions, aesthetics, and ethics--the landscapes of our inner and outer worlds--puzzling. The whole enterprise seemed irrelevant to his life. My student would have been a perfect inhabitant of John Brunner's Shock-Wave Rider, a novel which presents a future world in which the ability to "plug into" a new environment and a new set of relationships and "unplug" oneself from the past without suffering the trauma of disorientation is the essential requirement for success. But for my student that world was now.

I am not claiming that my student was a "typical" student of engineering or science, if such a creature exists. But neither was he psychologically disturbed, or maladjusted, or even unusually naive. He was, rather, a confident, successful, quite intelligent man whose education had never led him to question seriously his assumptions about himself and his world, but who sensed that he might have missed something along the way. I have met many students in the humanities who were equally unaware of the effects science and technology have upon their daily lives, but familiarity has perhaps dulled my sensitivity to the gaps in their education.

Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

Colleges and universities which do not have programs designed to study the relationships between technology and human values are inevitably going to produce students who feel something is missing in their education and search for it. If they attempt to explore the humanities on their own, they will find that most courses are not designed to meet their needs. Even those courses to which they are instinctively attracted, such as science fiction, because they appear to promise some kind of connections between the sciences and the humanities too often fail to make those connections explicit.

The traditionally designed science fiction course is a prime example of wasted opportunities. It usually consists of an historical survey of the genre. Beginning either with nineteenth-century prototypes of science fiction or with the American pulp tradition of the 1920's, the instructor lectures on the history of science fiction while students read "classics" in the field. This type of course fits neatly into an English curriculum and succeeds in making science fiction appear respectable by providing it with a legitimate ancestry, but it inevitably disappoints those students who are not humanities majors. It does not probe the attempts of contemporary science fiction writers to illuminate the relationship between science and human values. It does not introduce students to the variety of current science fiction. Most important, it does not adequately explore the challenge and delight of first-rate literature because the best written and most thoughtful works of science fiction have been produced within the past twenty years.

What is an instructor to do when confronted with one hundred students in a beginning science fiction course--especially when he discovers that the class consists of English majors, Science Fiction fans, scientists and engineers exploring the humanities, and sophomores seeking to fulfill distribution requirements painlessly? Although I can't claim to have solved this dilemma, I do wish to suggest an alternative to the type of introductory science fiction course most commonly offered, an alternative which seeks to address both aesthetic and ethical values.

The organization of the course I teach is designed first to expose students to as wide a variety of science fiction as possible, so that they may gain an awareness of the diverse possibilities of the genre, and second to study in greater depth two or three types of science fiction which raise aesthetic, ethical, political, and even religious issues. I begin with a brief history of the genre in order to "place" the literature we will be reading. Then we spend the first few weeks of the term discussing a wide variety of short stories. Given the difficulty of classifying types of science fiction, I do not insist on neat divisions among the stories, but I do try to choose stories which span the scope of the genre. Their subject matter includes space battles, technology, psychic powers, projected societies, psychology, hard science, myth, religion, etc. Their themes range from Campbellian affirmations of humanity's ability to triumph over all threats to nightmarish visions of technological inventiveness destroying human nature itself. I deliberately move from traditional well made tales to experimental narratives in which the distinctions between subjective and objective reality vanish. I try to unify the threatened chaos by focusing upon the ethical and aesthetic issues raised by the works. This allows me to raise traditional literary questions, such as the relationship between science fiction and fantasy or the limitations and advantages of the short story as a genre. It also provides an opportunity for exploring the diverse attitudes science fiction writers hold towards human nature, its inventive capabilities, and the uses to which they are put. Most students discover that, despite their differences in form, theme, and content, the stories repeatedly raise the same central questions about the relationships among science, technology, and human values.

The second portion of the course looks more closely at two or three types of science fiction novels which provide detailed explorations of these issues. I usually treat dystopian science fiction and mythic science fiction because there are numerous interesting works available. The dystopian section begins with a standard dystopia, such as Huxley's Brave New World or Orwell's 1984, which uses traditional literary techniques to suggest that human evil will lead to the destructive use of science and technology. Then I turn to a more ambiguous, experimental novel, such as John Brunner's Stand on Zanzibar, which suggests the dual potential of technology as savior or destroyer. This section concludes with a novel which analyzes the many ways in which technological, political, psychological, and ethical issues are intertwined. Ursula LeGuin's The Dispossessed is among the best. The growing experimentalism in form of these novels complements the increasing ambiguity of their world views.

The section on mythic science fiction follows a similar pattern. It opens with a classic, such as C. S. Lewis' Out of the Silent Planet, which delineates in clear, if bigoted, form a traditional view of the dichotomy between the scientific and humanistic-religious world views. A novel such as this inevitably raises the question of whether myth, religion, and science are mutually incompatible. I then turn to contemporary, experimental science fiction novels which suggest, as does Lewis, that scientific technology may allow humanity to assume god-like powers, or at least to act out its archetypal desires, but which take a less dogmatic view of its consequences. The sections on dystopias and myth complement each other because the first centers on current political and social issues while the second raises more abstract, far-reaching questions about the ability of humanity to use its knowledge wisely.

Clearly this course is not designed to convert scientists to a humanistic world view or vice versa, but it does provide a forum for introducing the debate over the connections between science and the humanities, for raising literary questions, and, not least important to the heart of an English teacher, for encouraging students to read and think about provocative works of literature. It allows for useful, focused discussion in over-crowded classrooms, or for lectures if the instructor prefers. Most students seem to respond well to its format. At any rate the student who wanted to know how humanists thought and felt stopped me two weeks after the conclusion of the course and told me he intended to recommend it to his friends in engineering. So apparently some communication took place across the disciplines.

--David M. Larson
English Department
The Cleveland State
University

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THE TEACHING OF SCIENCE FICTION - ANOTHER VIEW

There was a time many years ago when all I read was science fiction. I was about fourteen then--and the despair of my English teachers. There was another time, not so many years ago, when my career as a college English teacher might very well have depended upon my ability to devise an "innovative" course that would attract a diversity of students: yes, a course in science fiction.

Setting up such a course was surprisingly easy. Of course there was justified concern over the frivolity of such a subject, concern that students would desert Shakespeare for Forbidden Planet. But the mood of the 1960s certainly helped; the fact that the New York Times had instituted a science fiction column helped; finally, the soaring costs of college tuition helped--for students were eager and willing to pay for such a course.

And therein lies one of the great pleasures of teaching a science fiction class: the students are enthusiastic and highly motivated. Typically, my course draws about ninety students (two classes), students who represent virtually every department in the university. Many of them are well read in the field and eager to be introduced to new authors. (Some, I have found, are even experts in a particular aspect of science fiction and I always try to use their expertise in the classroom.) Also, because the subject attracts a disproportionate number of science and math majors, I have the extra advantage of an analytically trained group who are surprisingly sophisticated at breaking a piece of literature into its component parts. Scientists (unlike English majors) do not have to be convinced that everything has a structure, even literature.

Ah, and what of the literature? Is there any "literature" in the science fiction genre? Well, of course the answer is yes (if in doubt, re-read Wells's The Time Machine.) My biggest problem was selecting which works to focus upon. Part of that dilemma was resolved by the way I structured the course: it would be a history of science fiction, not entirely chronological but it would survey the sources of science fiction as well as the contemporary works. There has been amongst science fiction historians a running debate as to whether or not works as archaic as Homer's Odyssey or Swift's Gulliver's Travels fall within the boundaries of the genre. I could not entirely sidestep that controversy, so I begin my course with a discussion of early moon flight adventures, Lucian's The True History, Francis Godwin's The Man in the Moone, Cyrano de Bergerac's Voyage to the Moon. Then we discuss two early writers who were very involved in the science of their day; we read Book III of Gulliver's Travels and a selection of "mad scientist" stores by Nathaniel Hawthorne ("The Birthmark" and "Rappaccini's Daughter," for instance). The thrust of these opening discussions is to analyze why these writings are not science fiction though they manifest so many of its trappings. It is at this point that we can begin analyzing what science fiction is, what its major themes and conventions are, how it has always been a fine social barometer of the time in which it was written, and what its function is (hardly ever as mere escape literature, more often than not as social commentary, criticism, or satire). From there, we then move into the "big time" authors, starting with Mary Shelley's Frankenstein (which we also compare with the Boris Karloff movie, discussing throughout the semester whenever possible what happens to science fiction when it is transmitted to the screen.) While Shelley's work actually represents the crossroad between the gothic and the science fiction novel, it concerns itself with a theme pervasive throughout science fiction: man as creator. Ultimately, we compare Frankenstein with several other works, Capek's RUR, Asimov's I, Robot, and a variety of short stories from an excellent anthology, The Science Fiction Hall of Fame, Vol. I (edited by Robert Silverberg, published by Avon.) Our second "unit" deals with "hard" versus "soft" science fiction, that is the technological, gadgetry-oriented prose popularized by Jules Verne as opposed to the "fudged," pseudo-scientific double-talk of H. G. Wells, a scientist whose emphasis was upon the sociological implications of the scientific revolution. We read several works of each author, and Wells's The War of the Worlds inevitably leads into a discussion of alien invasions, alien encounters and the old favorite of all hardened science fiction readers: BEMs (Bug-Eyed Monsters, to the neophyte). In this unit I generally compare three stories of Martian confrontations, a 1930s gem called "The Martian Odyssey" by Stanley Weinbaum, a neat little chiller by Ray Bradbury called "Mars is Heaven," and a highly literate, allusive tale called "A Rose for Ecclesiastes" by Roger Zelazny. (Anyone who doubts the literary value of science fiction should add that one to their reading list.) The Zelazny story is a perfect tie-in to the religious inquiries that science fiction by its very nature must invoke. From our earlier studies of man as creator, we now deal with man as the last link in the progression to a new race of gods. Here we read Stranger in a Strange Land by Heinlein (a much overrated book, I think, but very popular on college campuses), and two novels by the rarely read but extremely seminal English philosopher-historian, Olaf Stapledon, his Odd John and Sirius. (Both are fascinating social satires on the plight of super-normals trapped in a mundane world.) Besides a number of short stories (also to be found in the Science Fiction Hall of Fame), we also read Childhood's End by Arthur C. Clarke which chronicles the end of man as he transcends himself on the road to Godhead (a favorite theme of Clarke's and well worth comparing with the script for 2001: A Space Odyssey---both very much influenced, according to Clarke's own admission, by Stapledon's work.) Finally, the last weeks in the course deal with science fiction as a modern mythology, as a relevant kind of epic. Again, there are short stories (including the classic James Blish tale, "Surface Tension"), but the major work we consider is Frank Herbert's Dune, a superb ecological treatise.

Naturally, choosing this curriculum was no easy or haphazard decision on my part: the entire field and history of the genre were open to me, and there was the added problem that some very important work has been contributed by non-English writers, Verne and Capek being the only two I eventually included. The advantage of my particular reading list is its natural grouping into thematic structures, and the inclusion of several authors with whom my students are generally unfamiliar. I also try to impress upon them that science fiction, like all literature, does have roots, it did not spring full grown within their own lifetimes, and perhaps---just perhaps---if they enjoyed the movie Forbidden Planet, they might want to read the original; it's called The Tempest by William Shakespeare.

In addition to the readings, I might add, the students are assigned two six-to-ten page papers which may either be intrinsic analyses or researched. Since I began teaching the course some six or seven years ago, a tremendous amount of ciritical material has become available, there being at least three highly reputable academic journals now devoted to the genre (Extrapolation and Science Fiction Studies in this country, Foundation in England), an academic organization called the Science Fiction Research Association, plus an increasing number of full length critical works, many of which began as doctoral dissertations.

The field is young and growing. Because academia has so recently taken an interest in it, there is still obviously a wealth of material to be catalogued, categorized, analyzed. Whether a movement back to a more traditional curriculum will eventually undermine the study of science fiction as a college subject in the future remains to be seen, but then, after all, the future is what science fiction is all about.

Barbara Bengels
Dept. of English
Hofstra University

FUN AND GAMES

Valuing Simulation

produced by Mobley, Luciani
and Assoc., Inc.
16 W. St., N.Y., N.Y. 10011
$10.95

This simulation offers a useful tool for promoting discussion in a course in science and technology. The apparatus is simple. It consists of a deck of sixty cards on which contrasting statements about science or technology are printed. Cards numbered '19' and '20', for example, read as follows: "The important thing in science is to strike out into the unknown -- even if the results are later proven incorrect." The authors recommend devoting two to four hours to this simulation and propose a six-stage process for its use, but I did not follow their suggestions, being unwilling to devote this much class time to a discussion simulation. Unless your goals are consonant with theirs, "depolarizing" value differences, their directions may be largely irrelevant to your use of the simulation, as it was to mine.

I successfully used these cards with a variation of the first four phases of the simulation in a class of 25 students for an hour. The initial stage involved the trading of cards among the participants until each arrived at a set of statements with which he or she could agree. The set of universally rejected cards is discarded, and in the next stage, participants attempt to form groups with others who share their views. The goal is for the participants to articulate what views they share that permits them to agree, or if some participants can not agree with any groups, why they disagree. My use of the simulation ended there. Its primary usefulness was in pointing out what statements were generally rejected and what kind of diversity of viewpoints on other issues existed in the class. The outcome of the simulation provided the substance for further class discussions.

This teaching technique should be most valuable in one of two course contexts: in a preliminary session of a course to encourage initial exchange of ideas on topics to be studied later, or in a session near the end to see what opinions existed after they had been examined. The cards offer a suggestive aid to developing your own simulation, tailored to a particular course. To this end, you should consider adding cards of special relevance and taking out others, a procedure I followed. Some of the cards are too vaguely formulated, ambiguous, or, like the pair that said "scientific truth need (do not need) mathematical validation," based on a false premise.

Adele Laslie
Dept. of Philosophy
Lehigh University

HANNAH ARENDT ON TECHNOLOGY AND HUMAN STATURE

None of Hannah Arendt's nine books is devoted wholly or even mostly to technology. In fact, though her writings cover an amazing variety of subjects, she really has only one subject: political thought. This is because, in contrast to most modern thinkers, Arendt believes that man gains dignity and humanity only to the extent that he is (as Aristotle called him) a political animal. Arendt is influenced by the ancient Greeks, for whom "outside the body politic man's life was not only and not even primarily insecure; . . . it was without meaning and dignity because under no circumstances could it leave any traces behind it." To be within a body politic means to be within a public realm where words and deeds will be witnessed and remembered, where one can be revealed in one's humanity. "In acting and speaking, men show who they are, reveal actively their unique personal identities." Further, only by action does man have the capacity to be free, to initiate new things, to create. Arendt cites St. Augustine: "That there be a beginning, man was created before whom there was nobody."

Action is never possible except in the presence of others: "to be isolated is to be deprived of the capacity to act." Without a public realm, an act would be futile and quickly forgotten. Indeed, Arendt believes that "without a space of appearance and without trusting in action and speech as a mode of being together, neither the reality of one's self, of one's own identity, nor the reality of the surrounding world can be established beyond doubt."

This body politic cannot simply be a group of people wandering together. There must be a man-made world to guarantee the permanence, stability, and durability of the public realm in which man may act. To achieve this man relies on his capacity for fabrication. If action is the supremely human experience of freedom, fabrication and the work necessary to fabricate are the means by which man builds for himself a human world and protects himself and his capacity for action from the destructive, endless processes of nature.

Arendt rejects the modern enthusiasm for the natural. To her, nature is the enemy of both action and man-made things, and therefore is the enemy of man's humanity. Man of course can never escape nature. He may act and he may fabricate, but he (or someone for him) must labor to survive because he is forever a victim of biological necessity. Laboring and consuming the fruits of labor is the life process, and is the most futile of man's endeavors because laboring leaves nothing behind, and "despite its futility, is born of a great urgency and motivated by a more powerful drive than anything else, because life itself depends upon it." Unlike Marx and his followers, Arendt sees laboring as the least human of all activities just because it is involuntary and serves to do no more than to continue the life process. It is potentially destructive of the world man fabricates to give himself a permanent home: the life process "everywhere uses up durability, wears it down, makes it disappear, until eventually dead matter . . . returns into the over-all gigantic circle of nature herself, where no beginning and no end exist and where all natural things swing in changeless, deathless repetition." Nature as well is potentially destructive of the capacity for action, for no one can act unless he can liberate himself from the demands of nature, from necessity.

To remain engulfed in the endless processes of nature, Arendt believes, is to be in oblivion. It is to be nobody. Even within the security and stability of the man-made world it is only the exceptional person who can act. "Only the best, who constantly prove themselves to be the best and who 'prefer immortal fame to mortal things,' are really human; the others, content with whatever pleasures nature will yield them, live and die like animals." The "best" are those whose deeds and words interrupt the endless daily routine of mere living. Their deeds and words are remembered in history, song, poem, and drama; they are praised by those who come after, and they inspire others and so help to change the world. They are, as the Greeks and Romans called them, heroes, and they gain a kind of immortality that negates their biological mortality.

Most people, even if they are secure in their man-made world, must (or choose to) be satisfied to live off the fruits of their labor and work. They never enter the fierce competition and glaring light of the public realm where they may act. It is important that one may be a slave to necessity, to the life processes of nature, even if one does not have to labor to live, for consumption of the fruits of labor is also a part of the natural process. If one does nothing but either labor or consume, then one is still immersed within the cycle of nature and still the slave to necessity, however secure and satisfied. Such a person never leaves his own private world where he cares only for his needs and wants. He may be happy, but for Arendt (refuting much of Western philosophy and most of modern social science) truly human stature is achieved not when one is happy but when one is free.

Arendt believes that since the Renaissance, the Classical reality of a public, human world has degenerated to the point where, in the twentieth century, we live in a condition of "worldlessness." We no longer have or believe in an enduring public realm that provides a place for action and for the preservation of the memory of actions. In its place has risen a mass society where everyone is forced back on his own private nature. Society gives him a place to "live," but no longer is there a world that can alone provide a sense of reality. Hence arises rootless mass man, characterized by "his loneliness,. . . his excitability and lack of standards; his capacity for consumption, accompanied by inability to judge, or even to distinguish; above all his egocentricity and . . .alienation from the world." The ways modern man accounts for his experience reflects the decline of the public realm and all it stood for. All branches of learning now treat "man as an entirely natural being whose life process can be handled in the same way as all other processes." Man no longer can act; rather he merely "behaves" according to natural processes. The study of nature, that is the natural sciences, becomes the standard by which man observes himself.

Modern science itself is a powerful reflection of the decline of the public realm. It is the modern era's way of looking at the world by rejecting anything human. It "seems to demand not only the renunciation of an anthropocentric or geocentric world view, but also a radical elimination of all anthropomorphic elements and principles, as they arise either from the world given to the five human senses or from the categories inherent in the human mind. . . . It has been the glory of modern science that it has been able to emancipate itself completely from all . . . anthropocentric, that is, truly humanistic concerns." There are, however, some strange consequences. Presupposing the abolition of a public, human world, natural science destroys "common" sense and questions not only the durability and stability of the given human world, but also whether that world exists at all. The motion of the earth, the law of inertia, the infinity of the universe, the behavior of matter at high velocities, and other advances of modern science--none of which could possibly be revealed to the senses--all presume a total loss of faith in the truth-revealing capacity of sensible reality.

Another strange consequence inherent in adopting the world view of modern science, one that became apparent only in the twentieth century, is that the reality science gives us turns out ultimately to be profoundly subjective: "man, whenever he tries to learn about things which neither are himself nor owe their existence to him, will ultimately encounter nothing but himself, his own constructions, and the patterns of his own actions." Science, in fact, constructs a "reality" which is nothing more than a reflection of our own minds, and, conversely, our own minds can transform reality into whatever we wish. "We can take almost any hypothesis and act upon it, with a sequence of results in reality which not only make sense but work. This means quite literally that everything is possible not only in the realm of ideas but in the field of reality itself."

Coinciding with the rise of modern science was the rise and glorification of the very thing which Arendt sees as most destructive of a human world: labor and the life process. "The sudden, spectacular rise of labor from the lowest, most despised position to the highest rank, as the most esteemed of human activities," began with John Locke and culminated with Marx, "where labor became the source of all productivity and the expression of the very humanity of man." The life process and life itself have become the highest good. The most praiseworthy activity is to do what is "natural," to produce and consume and thereby take part in the endless, futile processes of the vast cycle of nature.

Perhaps the most conspicuous manifestation of the destruction of a common world is technology. For Arendt, technology is the invasion of science into the human world where it releases the immense forces of nature. The danger, she says, is the whole of technology appears "as a large-scale biological process," to the point where soon all human activity will be "sucked into an enormously intensified life process" and will "follow automatically, without pain or effort," the rhythm of machines. What technology achieves in this respect is the laborer's age-old desire for endless, effortless production and consumption, for the abundance of a consumer's society.

Further, technology with its ingenious instruments yields the power to construct an environment that "makes it more and more unlikely every day that man will encounter anything in the world around him that is not man-made" and, hence, not himself. We are even reaching the point where technology permits man to do whatever he wishes without comprehending in human terms what it is he is doing.

For Arendt, technology is the instrument by which modern man, who no longer cares about the human stature that comes only from entering a common and public world, destroys that world. Technology puts the knowledge and power of science to the task of building a worldless mass society that fulfills the laborer's dream of "levelling all human activities to the common denominator of securing the necessities of life," and wherein all we do is "make a living." It is not a question of machines controlling people, an image Arendt rejects as false. The problem is that machine and man unite in an endless, irresistible metabolism of production and consumption that allows for nothing permanent and enduring, allows for no action that would reveal the unique humanity of each person. As parts of natural processes we can do no more than engage in the predictable mass behavior that is studied by the social scientist. In this era of technology, Arendt believes, human stature is not only lessened but is in danger of being destroyed altogether.

Mel A. Topf
Division of the Humanities
Roger Williams College

Note

Hannah Arendt, born in Germany, published nine books and many articles between her coming to the United States in 1941 and her death in New York in 1975. Most controversial are two studies of totalitarianism, The Origins of Totalitarianism and Eichmann in Jerusalem. Her views on science and technology are mainly in The Human Condition (Chicago: University of Chicago Press, 1958) and in two essays, "The Concept of History" and "The Conquest of Space and the Stature of Man." Both appear in Between Past and Future (New York: Viking Press, 1968). Margaret Canovan, a British scholar, has written a book-length study of Arendt: The Political Thought of Hannah Arendt (New York and London: Harcourt Brace Jovanovich, 1974).

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"TOWARDS A THEORY OF THE HUMANITIES"

A CONFERENCE REPORT

In November of this past autumn the University of Southern California's Center for the Humanities, with support from the National Endowment for the Humanities and the Rockefeller Foundation, sponsored a national conference entitled "Towards a Theory of the Humanities." The conference organizers drew together some 200 people, selected from over 1100 applicants, for the announced purpose of exploring the nature and structure of the humanities, especially in relation to the sciences. My opinion was, and continues to be, that the conference was a disaster, mitigated only by what I learned from the evaluations of the conference subsequently communicated to me by a considerable number of my fellow participants; and therein lies the tale that I would like to lay before you.

When I say that the conference was a disaster for me, I mean to pass judgement on the content and the quality of the invited papers, and also on the format within which those papers were presented. If I now want to lay this before you, an audience composed overwhelmingly of people who were not present at the conference, I do so not to persuade you that my judgement is correct, but to share what I believe are some valuable insights gleaned from the experience of the conference and its aftermath. The invited papers were presented by an impressive array of seventeen noted humanist scholars, among them Ihab Hassan, Benjamin DeMott, Marshall Cohen, Ronald Berman, Stanley Cavell, Thomas Haskell, Leo Bersani, Arnold Thackray, David Rosenhan and Adolf Grunbaum. With only a few exceptions, it was my opinion that the papers had little or no relevance to the announced theme of the conference and ranged in quality from exquisitely detailed to manifestly slipshod. Most gave the impression, to me at least, that they were not specifically crafted for this occasion, but were works at hand dusted off and offered up to the brethren in awe assembled. I, and many others, were struck by the extent to which the presentations were performances in the humanities and not explorations of or discourses on the humanities. Almost all were riddled with, or explicitly based upon, malicious ad hominem references to the work of literary, artistic or critical figures of wide reputation. One paper, a particularly interminable one for me, explored the depths of the human condition through the experience of a young graduate student whose wife died in an automobile accident, in the process repeatedly burlesquing and mocking the involvement of the state police officers who had to handle the pulped body and bring the news of the wife's death to her husband. Another argued for three-quarters of an hour that Jacques Derrida and Ludwig Wittgenstein were so far apart in their thinking that they could not be in any way correlated, in the process providing (unwittingly?) a context within which both were well correlated.

This conference seemed to me an occasion that demanded more than destructive criticism as a response. Here was a wonderful opportunity lost by locking 200 cultivated and dedicated scholar-educators into a format that subjected them to two full days of lectures (with breaks for lunch) and only made provision for questions and discussion, for engaging the authors of these papers, at parallel panel-forums in the evenings! Hour after hour, lecture after lecture, there was no opportunity for a question, a criticism, a challenge, a disagreement; no opportunity for spontaneous response, only amorphous and long-after-the-fact conversations likely to follow from putting 100 people and three speakers into one room many hours after those speakers had spoken.

What does this say about humanists and what does it say about conferences and their organization? I wanted to find out and I offered to solicit evaluations from the participants on the understanding that I was making the offer because I was critical of the conference. The conference director accepted my offer, announced my intention and fifty people subsequently responded to the questionnaire that I distributed. Not only does this strike me as an exemplary response-rate, but the length and the intensity of many of the responses moved and enlightened me, far more than the conference itself had. To tabulate the responses would be unnecessarily brutal. All but a handful of the respondents were critical of the conference and most were severely critical. Overwhelmingly, the respondents agreed that the lecture format was intolerable and inexcusable and that the papers were too long, self-indulgent and not relevant to the theme of the conference (with a very few exceptions). Most respondents thought the papers imprecisely formulated and not of a quality commensurate with the reputations that won invitations to speak (again with a few exceptions). Interestingly, almost every speaker was singled out by someone as a particularly good performer and by someone else as a particularly bad performer! Ihab Hassan, Marshall Cohen, Ronald Berman and Benjamin DeMott appeared most commonly as, for one reason or another, having delivered the most relevant and/or the best papers. Almost every response argued for two things: small workshop formats at which short presentations would be followed by intensive engagement with the ideas in the presentation and very tight control by conference directors over the content of invited presentations.

For me, this conference raised serious doubts about the value of large-scale conferences involving "name" speakers at considerable expense. It has caused me to be very precise about the invitations to speak at Lehigh that I have made since returning from the conference and about the content of the papers that I have been invited to give since my return. Perhaps large-scale conferences should be left largely social affairs and serious conferring be made local, with the assistance of such technologies as audio- and video-taping of guest lectures/panel discussions and conference telephone calls in comfortable surroundings. Does this sound inhuman? So was this humanist conference, and to many more participants than just myself.

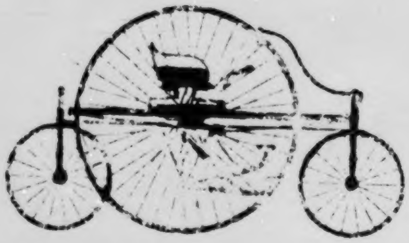
Again, what does the very wide-spread perception that the conference papers were not well conceived vis-a-vis this particular conference tell us about the humanities, especially in relation to the sciences? I returned with a very gloomy conviction that the humanities, for all their blustering about their unique handle on Man, cannot match the sciences - especially the physical sciences, for considered, intelligent, clearly-formulated and precisely-reasoned presentations of ideas. In the twenty years that I have (sporadically, to be sure) attended lectures in the physical sciences, I cannot recall having ever come away without a clear conception of what the speaker was talking about, what he/she had to say about it and what the basis was for what they were saying (this does not imply substantive understanding, of course). I cannot speak quite so strongly about social science lectures that I have attended and, alas, I can easily think of many philosophy and literature colloquia that were positively murky.

The USC conference was composed largely (more than 50%) of people in language and literature. Many were in history; very few were from medicine, law, philosophy, mathematics and physical science. The only session devoted to science and humanism was the favorite choice of respondents as one session whose papers were well-formulated and to some discernible point, although there was no general agreement that this point advanced the goal of the conference. Is it possible to infer that echt-humanists can only be forced to clear and precise thinking under threat of a negative tenure decision? Now that my initial bitterness has worn off, I unequivocally answer 'nonsense'. However, it seems to me more often the case that humanists work out their ideas in the context of conversing with colleagues and students, in the course of interacting with other people, while the scientist is more likely to demand a higher level of clarity and precision before saying anything at all to anyone.

Never have I heard as part of scientific papers, the kinds of personally insulting references that were commonly embedded in most of the papers presented at this conference. (This parallels a recent experience of a Lehigh chemist, Ned Heindel who, as part of an HPT project, attended a conference on the Black Death at SUNY Binghamton. He, too, commented to me on being struck by the intensely ad hominem character of many of the literary and art-historical papers and question-and-answer periods, in sharp contrast to the papers presented in the medical section of the same conference.)

The questions raised by the conference proposers -- what are the humanities as academic disciplines? what does it mean to be a humanist, by comparison with what it means to be a scientist? what relation exists between the humanities and the sciences, both within the curricular structure of the modern university and within its ideal intellectual order?-- are awfully good questions. The expectation of hearing first-rate minds discourse on them and of arguing with colleagues from many places, many disciplines and many kinds of institutions about the meaning and merit of these discourses, is what moved me (and almost everyone else, I would guess) to want to attend this conference. For a very large percentage of attendees, the conference failed to meet these expectations, but judging from the responses it has forced a considerable number of people to pay more explicit attention to the issues that motivated calling the conference in the first place. As part of the questionnaire that I circulated, I asked what the conferees would have said had they been invited to speak at the conference. I received in reply a number of lengthy, considered and insightful answers the gist of which I hope to summarize in a future Newsletter. There is much in them that is relevant to the task of exploring STS interactions and perhaps you (readers) will be provoked to write back to us with ideas of your own.

Steven L. Goldman



BOOK REVIEW

Hal Hellman, Technophobia:
Getting Out of the Technology Trap
New York: M. Evans and Co., Inc.,
1976. xvi + 307 pp. Bibliography.
$8.95.

Science writer, Hal Hellman, tries to dissuade his readers of "technophobia," or the fear of technology, in this wide-ranging volume by the same title. The author stresses that there are rational fears and irrational fears regarding technology and its interrelationships with man. "Like it or not, this is a technological world, and it requires at least some technological literacy (p. xiii)." While debunking "technophobia" as unfounded and unrealistic, Hellman also asserts the dangers of a "blind, uncomprehending reverence for science and technology (p. xiv)."

Hellman sets up his argument by suggesting that "future shock" as coined by Alvin Toffler and adopted by others was more a phenomenon of the 19th than the 20th century. Using 19th century examples of change such as the transportation revolution epitomized by the railroad and the telegraph, he suggests that what we are experiencing today is not so much a previously unknown future shock of too much change, too quickly, but, rather, an information overload. The obvious and largely unanswered question is whether this perceived change is any less real or important today just because there were rapid changes prior to 1900?

The following two chapters (3 and 4) try to assess the quality of twentieth century life and conclude that although all our problems have not been solved, human existence for most people is measurably better than it was in the "good old days." Discussions of bread, subways, assembly lines, and the automobile are utilized to show that life today is better than when characterized by widespread disease, starvation, flogging, and dirt.

That this is true, is clear, However, it does beg the issue of the very real changes inherent in today's technology. The author's claim that our problems are not technical, but rather social, cultural, and economic is somewhat glib and misses the point. As he notes, technology needs to be understood for it to be dealt with properly, but to characterize, as he seems to, all those who oppose some aspect or impact of technology on society as being unfamiliar with technology or unable "to cope with modern-day society" is as extreme as damning all technology. Those who would deny all technology and its obvious benefits are few and far between. As witnessed by the emergence of numerous academic programs, governmental agencies, and private organizations, we have moved far beyond this simplistic view and are reaching for answers that take cognizance of both the benefits and liabilities of today's technology. To seemingly and superficially lump together everyone who takes a critical look at technology is to recloud the issue and negate the steps already taken, steps for which the author himself is calling.

The middle third of the book (chapters 5 - 7) is an attempt to show the reader that technology "offers not only material benefits but the chance for social justice (p. 79)." While this may in large part be true, the author loses some credence by the superficiality with which he treats his evidence. To cite two examples - women's work and nuclear power - should not detract from his overall point, but only serve to remind us of Hellman's own insistence on detailed analysis of the technology or issue at stake.

In the case of women's work, Hellman queries, "how about these women, who have been freed from the drudgery of long hours of clothes washing, food preparation, hand sewing, and so on? Do they feel they have been dehumanized? (p. 117)." Historians such as Joann Vanek and Ruth Swartz Cowan have shown that, while it is true that technology of the electric stove, washer, and dryer has removed much of the heavy physical work of carrying wood to heat the water to wash clothes and the iron to iron them, the number of weekly washings has correspondingly increased with little, if any, savings in time. Likewise, the widespread adoption of indoor plumbing and concomitant bathroom fixtures has created a time consuming, hygenic need for care and cleaning in a way the privy never did.

A second case in point is the adoption of nuclear power. Hellman suggests the fears of nuclear theft and contamination are either of minimal risk or solvable by future technological developments (pp. 131-136). I believe Hellman misreads the foes of nuclear power, if he feels they are against the technology, for it is the human misuse of a technology that has the capability of ultimate destruction that they fear. When, as he himself admits, men "have been at each other's throats since the beginnings of history (p. 131)," the problem seems self-evident. The storage of wastes, many of which have unacceptable radioactive lives that are longer than the history of the most stable governments known to man, presents not only a technological problem, but a social one as well. Here, it is the superficiality with which the author treats some very important technological developments and future problems that troubles me, both as an historian and as a general reader.

In the remaining third of the book, Hellman offers a variety of suggestions for solving some of our societal problems, including cutting down on resource consumption, the increased use of technology assessment, and, ironically, the use of consumer action, reminiscent of the "anti-technologist," Charles Reich, in *The Greening of America*.

There is nothing terribly new or striking here, rather, it is a calm summary of many thinkers. The general point made is that most, if not all, of these potential answers require the use of technology. As noted above, most societal analysts today accept this point of view. They may debate the specifics but not the general acceptance. Thus, I find Hellman's, in places, impassioned plea against the technophobes to be misleading. It lumps too much together without clearly distinguishing the varied components. This book is well worth reading, but should be used with a certain amount of caution. It complements well Samuel Florman's *The Existential Pleasures of Engineering*, which deals directly with specific anti-technologists and how they are related to the engineering profession in particular. *Technophobia*, especially if it were to be published in paperback, would make interesting reading for an introductory college course in technology and human values.

Stephen Cutcliffe
Lehigh University

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JOURNAL REVIEW

ANTHRO-TECH: A Journal of Speculative Anthropology (Darlene Thomas, Anthropology Dept., Lock Haven State College, Lock Haven, PA. 17745).

This journal is "intended to deal with the existance of humankind in a technologized world." There is little information about the cultural adaptations which humans are expected to make in a rapidly evolving technological world, or on the life styles which have evolved or are evolving in technological societies. ANTHRO-TECH provides some stimulating views of the world from a perspective which is too little used in our world. SF scholars and teachers should be familiar with the title.

Source: Science Fiction Newsletter

TEACHING MODULES FOR SCIENCE/NON-SCIENCE UNDERGRADUATES

A $131 thousand grant has been awarded to the State University of New York at Stony Brook to develop socio-technological instructional materials aimed at improving college level science education for majors and non-majors alike. The two-year grant from the National Science Foundation has been given to the Department of Technology and Society of Stony Brook's College of Engineering and Applied Sciences. The project director is Dr. Thomas Liao. Assistant Professor of Technology and Society.

The project entails the development and implementation of a set of learning modules that deal with current and future socio-technological problems and issues. These modules or case studies will be designed to help students learn about the methods and impact of assessing the consequences of using technology. The intended audiences for these modules are college undergraduate engineering and science majors, other undergraduate students and adults in continuing education programs. The project goals center on the reduction of the "cultural gap" between the science and the non-science audiences.

"Engineering is now concerned primarily with the development of new technology which impacts strongly on the individual in his or her daily life," stated Dr. Liao. "We must feed into the highly structured engineering curriculum a sequence of contacts with problems drawn from the 'real world' of the 1980's so that the engineering student develops a clear understanding of the role of the humanities, and the social and behavioral sciences. Likewise," he continued, "the non-science student must be made to understand that solutions to socio-technological problems of significance involve the assessment of trade-offs between alternatives."

Ten to fifteen case studies will be developed. "The format must be flexible," Dr. Liao said, "because the modules will serve undergraduates with professional engineering and applied science goals, students whose professional aims require limited exposure to the sciences, students for whom science may later serve as a decision-making tool on a science-related public issue, and students seeking greater technological knowledge."

The topics that will be chosen for case study are intended to motivate students to expand their learning horizons (engineering students into liberal arts and non-engineering into technology). Each topic must involve one or more fundamental concepts in engineering and applied science that can be presented to science and non-science students alike. Additionally, the topic must be an important public policy issue involving social, political and economic considerations and constraints.

Suggested case study topics include: the artificial heart program; building access for the handicapped; home fire protection; emergency medical service systems; supersonic transport; high speed ground transportation; water conservation and the public; energy conservation and the public; personalized rapid transit systems; weather modification; earthquake prediction; electronic fund transfer; supermarket automation; and auto safety.

The first prototype case study will be developed this academic year and tested at Stony Brook. Two faculty members from technology and society programs at other universities will join the Stony Brook collaborators to select the entire set of modules and, in the summer of 1978, to write these studies. In the next academic year, the modules will be tested, revised if necessary, and put into final form. It is anticipated that printed studies can be disseminated and used throughout the country by the early 1980's. The final case studies will be developed in self-contained forms (including reference data, student activities and other information) so that they can be used by the professor in a class of 50 or more students, with the detailed discussion in seminar or recitation sessions under the direction of graduate or teaching assistants. Presentation does not require changes in teaching ratios or costs incurred by additional equipment or facilities.

For further information on the project write to:

Dr. Thomas Liao
Dept. of Technology and Society
SUNY at Stony Brook
Stony Brook, N. Y. 11794

OPEN FORUM

Continued correspondence regarding a list of active scholars who would be willing to visit campuses for lectures, colloquia, etc., includes the following individuals and topics. HPT News can take no responsibility other than to list those people who are willing to offer their services in this regard. All speaking arrangements must be made directly with the individual by the sponsoring institution. However, we will be glad to continue this service and, if you desire to have your name listed, please include your address, telephone number, and suggested titles or subjects on which you would be willing to speak. Editor

Dr. Robley E. George, Director
The Center for the Study of Democratic Societies
Box 475
Manhattan Beach, CA 90266

"The scientific study of democracy"
"Ethics and values in the science of economics during major societal change"
"Alternative economic systems"
"Socio-economic democracy"
"Science and technology in a democracy"

Dr. Steven L. Goldman, Director
Humanities Perspectives on Technology Program and
Andrew W. Mellon Professor in the Humanities
Lehigh University
Maginnes Hall #9
Bethlehem, PA 18015

Office: 215-691-7000, x845

"Medieval roots of modern science"
"Renaissance magical nature philosophy and the evolution of modern science"
Topics on Judaic and Islamic philosophy.
Topics in 19th and 20th century history and philosophy of science.
Technology and science.

Prof. Don Ihde
Dept. of Philosophy
SUNY-Stony Brook
Stony Brook, N.Y. 11790

Office: 516-246-6560
"A Phenomenology of Instrumentation:
   Part I Perception Transformed
   Part II The Instrument as Mediator
   Part III Technics as Telos"
"Heidegger's Philosophy of Technology"
"The Experience of Technology"
"The Existential Impact of Computer Technology"

Prof. Michael Platt
Dept. of English
Franklin and Marshall College
Lancaster, PA 17604

(Prof. Platt teaches medical ethics in the HAPOS program at F & M and was an NEH fellow at the Hastings Center for Biomedical Ethics in 1975-76.)

717-291-4061
"Would Human Life Be Better Without Death?" (on current proposals to extend life infinitely, their origins in Bacon, and their consequences).
"Why Hobbes Neglects Medicine in His Leviathan"
"Bacon's New Science and His New Fear" (the unscientific origins of the modern scientific project)
"Bacon's *New Atlantis*" (chiefly on the relation between the modern scientific project and Biblical religion)
"C. S. Lewis on the Modern Scientific Project"
"M. B. Forster on the Modern Scientific Project"
"The Fabulous Genesis of Descartes' Method" (on the relation of Descartes' *Discourse of the Method*...to the Biblical God)
"Expecting and Delivering" (a dialogue on making and knowing, on birth, in the hospital and at home, and on poetry as *poesis* [making]).

Prof. John M. Wilkes
Dept. of Social Science and Policy Studies
Worcester Polytechnic Institute
Worcester, MA 01609

617-753-1411
"Technology, Technologists, and Social Problems"
(Subject derived from Ellul's description and criticism of a so-called "technological mentality" as the reason for the seemingly autonomous nature of technology.)

W. F. Williams
Director of Combined Studies
Faculty of Science
The University of Leeds
Leeds, United Kingdom LS2 9JT

(Available in the United States only during April 1978)

Telephone: 31751
"Politics of Technology"
"Neutrality of Science and Technology"
Seminars on the Science in a Social Context Project (SISCON) in the U. K.

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

COMPUTERS AND PEOPLE 26 (8), AUGUST 1977.

Features entries from the 15th Annual Computer Art Exposition. The twenty-three reproductions, contributed by entrants from a number of nations, represent natural objects, geometric designs, graphics for use in theater set, tapestry, and urban design. Comments by their creators are juxtaposed to many of the works. Those who peruse the issue should find the designs eye-catching at minimum. But the journal's editor, Edmund Berkeley, comments cynically: "The magazine Computers and People....has published computer art in the August issue for each year from 1963 to 1977, fifteen years. Perhaps we have published 700 pieces of computer art. But, has any computer art that is really beautiful, important, and rich in impression for the beholder, yet been published? I doubt it....."

FERGUSON, EUGENE S. "THE MIND'S EYE: NONVERBAL THOUGHT IN TECHNOLOGY." SCIENCE 197 (4306): 827-36, AUGUST 26, 1977.

Western technology can not be understood without an appreciation of the visual, imaginative mode of thought. Pyramids and rockets were a vision in someone's mind before they were reduced to geometry and thermodynamics. Ferguson clarifies the significance of nonverbal thought and traces the nonliterary and nonscientific aspect of conceptualization since the Renaissance. The "illustrated machine books" of Ramelli, DaVinci, Agricola, Martini, Leupold, and Diderot demonstrate that design exceeded society's needs and that the artist-engineers were posing questions previously unasked and solving problems by drawing many varieties of a defice. Inventions in graphic arts in the Renaissance, e.g. perspective, the "exploded" view, and engraving itself, had profound effect on the advance of science and technology. Ferguson laments the lack of courses in "visual thinking" in engineering schools. The view that results in the labelling of design projects as "Rube Goldberg" exercises reveals a dangerous assumption that perceptive processes are more primitive than verbal or mathematical thought. In an "analytical engineering curriculum," it is courses in design which "provide one of the few remaining links to the complexities of the real world." Presently, such courses have low status and if they disappear such "silly and costly errors" as the Metroliner railroad cars unable to run because "a fan sucks snow into the electrical system" will proliferate. Extensive documentation.

INOUE, ARLENE; SUSSKIND, CHARLES. "TECHNOLOGICAL TRENDS AND NATIONAL POLICY, 1937: THE FIRST MODERN TECHNOLOGY ASSESSMENT." TECHNOLOGY AND CULTURE 18(4): 593-621, OCTOBER 1977.

As the authors observe, "one sign that technology assessment is making the transition from invisible college to institution is the growing corpus of investigations into its history." This paper critically reviews a report issued by the Roosevelt Administration as an early piece of technology assessment. Written by major social scientists, other academicians and technologists, the volume opened with discussion of the nature of innovation and its spread, the relationship of basic research to technological change, and other theoretical issues. The body of the report analyzed the development of specific industries. William Ogburn, the prominent social scientist and principal coordinator of the project, was disappointed in the result. The authors of the present review conclude, as he did, that while the report was descriptively strong and thorough, the contributors were brief and cautious in predicting consequences of specific technological developments and overly reluctant to indulge in long-range forecasting.

KAHN, KENNETH AND HENRY LIEBERMAN. "COMPUTER ANIMATION: SNOW WHITE'S DREAM MACHINE." TECHNOLOGY REVIEW 80(1): 34-46, OCTOBER/NOVEMBER 1977.

Computers take the tedious labor out of animation, add modifiability, and make the process viable for planners, engineers, industrial designers, and scientists. Uses, techniques, and advances in equipment during the last fifteen years are sketched by two innovators whose verve must have been partially generated by "unofficial" late-night indulging in computer games like "Space War" and "Dazzle Dart." In ten years those involved with computer animation have solved the problems of "perspective, attention to light and shadow, recession, and the realistic use of texture and color." Key-frame animation, "paint brush" system, robot-like "display turtle" artist, etc. are discussed. Negroponte speculates that cheaper and better systems will replace the TV watcher with the "Sunday painter" who will create his own TV shows. Programming non-initiates miss some of the wit and charm here.

KAPP, K. WILLIAM. "ENVIRONMENT AND TECHNOLOGY: NEW FRONTIERS FOR THE SOCIAL AND NATURAL SCIENCES." JOURNAL OF ECONOMIC ISSUES 11 (3): 527-40, SEPTEMBER 1977.

This reprint of a paper read at the International Congress of Scientists on the Human Environment 1975 is a plea for "transdisciplinary" exploration of environmental distruption and the complex interaction between the natural environment, the economy, and social costs. Kapp feels that years of talking about interdisciplinarity has not resulted in the development of appropriate "techniques, methods, and attitudes" for such work. While worldwide industrial expansion and the market mechanism are the causes of present pollution, the key to improvement lies in three types of measures: strict public control of noxious inputs, the development and promotion of technologies with low ecological impact, reuse and recovery of waste materials. Attitudes represent the primary area of change. The "utilitarian moral principle" which considers economic growth as an autonomous process measured in terms of GNP must give was to goals that rate the quality of growth. We also need effective social and environmental indicators to measure forms of disruption and their effects.

LAWLESS, EDWARD W. TECHNOLOGY AND SOCIAL SHOCK. RUTGERS UNIVERSITY PRESS, 1977. 616P.

Lawless, head of the Technology Assessment Section of the Midwest Research Institute, provides in-depth case studies of forty-five "episodes of public alarm over technology--social shocks." The scope ranges from issues with wide-spread effects, such as flouridation, thalidomide, oral contraceptives, DDT, enzyme detergents, x-ray shoe-fitting machines, to relatively more isolated incidents, e.g. Torrey Canyon, Santa Barbara oil leak, the closing of a plant in Saltville, Va. due to inability to meet pollution standards, Dugway sheep kill, synthetic turf as related to sports injuries, and even the Derby disqualification of Dancer's Image. The format of each case study provides an abstract of event, graphic depiction of time line, narrative account, key events, impact and resultant actions. A final overview discusses characteristics and commonalities of the cases. Focus of interest throughout is on why concern or alarm was raised and how it was transferred to the public. The role of the mass media receives special attention. Well documented with popular and accessible materials; citation of technical studies is limited. Useful for undergraduate classes discussing technology assessment and/or technology and values.

LEWIS, W. DAVID. "THE SMITHSONIAN INSTITUTION'S '1876' EXHIBIT." TECHNOLOGY AND CULTURE 18 (4): 670-684, OCTOBER, 1977.

An exuberant guided tour of the exhibit in the Arts and Industries Building, complete with photos, background notes and perceptive observations.

LINEHAN, THOMAS M. "RHETORICAL TECHNIQUE AND MORAL PURPOSE IN DICKENS'S HARD TIMES." UNIVERSITY OF TORONTO QUARTERLY 47 (1): 22-36, FALL 1977.

While Dickens's indictment of industrial life was expressed not only in Hard Times, but also in journalistic essays, it was the novel that caused his audience to "grow restive and worried." Emotion is generated by the intensity of this literary work in which technique is dictated by the author's "single-minded moral purpose"--to demonstrate the pernicious nature and the ruinous consequences to humanity of the philosophy of Fact. Devices used to achieve this end include: development of the character Gradgrind with his basic innocence underlying a hard-headed realism and an ill-formed equation of mathematics with the real world, the contrast between Tom and Louisa, unfavorable treatment of the labor union, multiple connotations of the word "Fancy," the juxtaposition of the Coketown hands with Sleary's cricus troupers. Unlike the complexity of Dickens's other novels of the 1850s, such as David Copperfield and Bleak House, here "compression and condensation" are the means to his end.

MARIEN, MICHAEL. "THE TWO VISIONS OF POST-INDUSTRIAL SOCIETY." FUTURES 9 (5): 415-431, 1977.

Though many labels for social configurations of coming decades have been coined, Marien believes that the term "post-industrial society" has emerged as a front-runner. It was Daniel Bell who first used the term to describe a highly technological, affluent, centralized service society; this connotation has been promulgated by other prominent social scientists, buttressed by forecasts and accepted, though bitterly, by critics of the technological order. The alternative concept of the post-industrial society as decentralized and agrarian, supported by "appropriate," small-scale technology, has been advocated by a smaller number of visionary humanists and ecologists. Marien, obviously drawn to the latter vision, sees it gaining strength and acceptance.

MODELL, MICHAEL. "SUSTAINING LIFE IN A SPACE COLONY. TECHNOLOGY REVIEW 79 (8): 36-43, AUGUST/SEPTEMBER 1977.

CRAWLEY, EDWARD F. "DESIGNING THE SPACE COLONY." TECHNOLOGY REVIEW 79 (8): 44-50, AUGUST/SEPTEMBER 1977.

ROBINSON, GEORGE S. "SPACE LAW." TECHNOLOGY REVIEW 80 (1): 59-64, OCTOBER/NOVEMBER 1977.

The imaginations of researchers and public alike have tunred once again to space travel, this time not to heroic solo flight, but to the possibility of self-sustaining space colonies. Modell describes the components of a CELSS (Closed Ecological Life Support System) that would provide a nutritious, if restrictive diet and water for people, animals, and plants, while converting all outputs of these three subsystems into inputs to the system. While Modell is concerned with life support, Crawley ponders the physical support of 1,000 people, in a state-of-the-art engineering study of a prototype space colony. He visualizes a giant, sunlight-collecting mirror, focusing light on the minute colony by means of an equally mammoth reflector. The grand scheme is buttressed with construction details and specifications for appropriate structural steels, and estimates of building costs and time. With the space colony housed, fed, and viable, Robinson considers how it is to be governed, differentiating two emerging categories of "space law." The first, earth-oriented type is already taking shape through international agreements and treaties. The more exotic question of law-making for future space communities has yet to emerge, but Robinson enters an early plea for the independence of "spacekind" from earthly domination.

NELSON, DANIEL. "TAYLORISM AND THE WORKERS AT BETHLEHEM STEEL, 1898-1901." PENNSYLVANIA MAGAZINE OF HISTORY AND BIOGRAPHY 101(4): 487-505, OCTOBER 1977.

Rather than providing evidence of the efficacy of scientific management's time-study and "differential piece rate," the reorganization of Bethlehem's workers was a "modest affair" that demonstrated "haphazard, unsystematic methods" as well as the dehumanization of the worker. Taylor, brought in by company president Linderman, rapidly reorganized the managers rather than the workers. His only significant manipualtion of laborers involved pig iron handlers in the yard. The capacity of a "first class" man was determined by the output of 10 carefully chosen men observed just one day. One of three who achieved the standard (a tripling of previous average production), a Pennsylvania Dutchman named Noll, became conceptualized in the literature as the hero "Schmidt." What is not recorded is that Noll later "lost his job and home because of excessive drinking." Nelson notes that the Frederick Taylor papers are at Stevens Institute of Technology.

"SCIENCE AND LATIN AMERICA." ISSUE TITLE: IMPACT OF SCIENCE ON SOCIETY 27(3): JULY-SEPTEMBER 1977.

A survey of pre-Columbian science and technology spans the period from the earliest projectile points to the evolved Peruvian quipu. Recent developments, including regional cooperation in scientific research and in technology transfer are outlined. The highly contrasting technological problems encountered on the continent are dramatized by the juxtaposition of papers on hydroelectric development in wet Guyana and combating desertification in Chile.

SINCLAIR, GEORGE. "A CALL FOR A PHILOSOPHY OF ENGINEERING." TECHNOLOGY AND CULTURE 18 (4): 685-9, OCTOBER, 1977.

One reason for studying the history and philosophy of technology is to achieve an understanding of the nature of technology that will help solve the problems of its contemporary impact on society. Sinclair argues that historians have, in studying the nuts and bolts, ignored the human factor in engineering works. The result is that "the engineer takes little interest in the philosophy of technology because he does not find in it that which would aid him in determining his true role in society."

THE SOCIAL IMPACT OF THE TELEPHONE, ED. BY ITHIEL DE SOLA POOL. CAMBRIDGE, MASS.: MIT PRESS, 1977.

The papers collected here were originally presented at a series of seminars held at MIT in celebration of the centennial of the telephone. Oddly, there have been few previous studies of this everyday device as a cause of social change. The opening section may be termed a history of the sociology of the invention. Papers in subsequent sections examine the effect of the telephone on daily life, emphasizing the reemergence through the phone of oral discourse as the major form of communication, and noting the development of new patterns of social interaction from finely developed telephone etiquette to crisis intervention services.

--Christine Roysdon
--Judith Mistichelli
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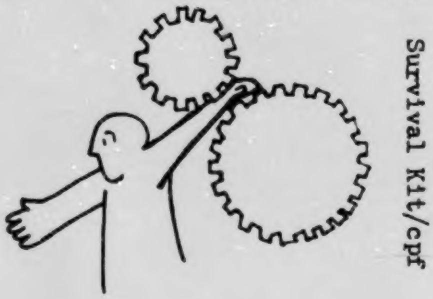

BEYOND TECHNICS: HUMANISTIC INTERACTIONS WITH TECHNOLOGY. A BASIC COLLECTION GUIDE. by Judith Mistichelli and Christine Roysdon. Humanities Perspectives on Technology, Lehigh University, 1978.

Highly annotated guide to the 100+ books which provide the most significant statements resulting from considerations of technology from humanistic points of view. The bibliography attempts to provide the researcher, teacher, or student new to this interdisciplinary field with a basis both for an understanding of treatments of the issues to date and for an investigation of the relevant scholarship. Overviews, anthologies, historical and case studies are selected, plus interactive studies of technology with art, literary criticism, fiction, science fiction, poetry, social impact, technology assessment, philosophy and ethics. Major interdisciplinary journals are also described. Works included span from Charles Dickens' Hard Times (1854) to Langdon Winner's Autonomous Technology (1977).

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ON THE ROAD TO STS

With the continuing growth in science, technology and society programs, especially with the quite appropriate new interest in inaugurating STS-style courses at small colleges, have come two serious impediments to success. One of these impediments is practical, the other theoretical, but for both courage and clear vision are needed if they are to be overcome. Genius and cash will not do.

I give pride of place to the practical. The STS programs with which I am familiar have all run into major problems after three or four years of operation. The symptoms these programs commonly display are: a "literarization" of the program, that is, a disproportionate influx of faculty located in literature, history, and American studies departments; a possibly coordinated efflux of science and engineering faculty from the program, if they were involved from the beginning, or a continuing lack of involvement if they were not; disappointing enrollment in higher level course offerings (a sign of lack of student involvement); and a sense among faculty members at large that the original promise of the program, which they willingly concede, has not been, and gives no early sign of being, fulfilled.

There are, I believe, a small number of factors whose consideration would substantially improve the prospect for a viable STS program or package of STS-style courses. I would like to suggest three as being of special importance.

I. It seems essential that at the very outset the goals of the program be clearly articulated and made the decisive factor in determining what is to be done, what is not to be done, and how things are to be done. This would appear to be elementary in the extreme and perhaps it is in principle. In practice, something seems to prevent its implementation.

Three levels of goals are discriminable, each entailing a more elaborate, a more demanding, and a more expensive program than the preceding one: (a) sensitizing students to issues; (b) substantive treatment of specific themes; (c) policy studies.

(a) The goal of sensitizing students to issues raised by the interaction of ideas, machines, and values, issues in which their own lives are necessarily implicated, is the most readily achieveable goal. It does not demand acute faculty specialization, major retraining by faculty, hiring new faculty, or the creation of a new option within the baccalaureate degree program. In spite of this, it is neither a trivial nor a superficial objective. Why, then, does explicitly announcing it as one's goal seem to go against the grain of academics?

(b) Treating specific themes substantively, that is, taking as one's goal the accurate presentation of the thought of a number of thinkers, or of the history of a period, or of the development of an idea, movement or school, entails a major increase in complexity. Specific faculty expertise will be required, students will almost certainly be expected to have fulfilled prerequisites in order to register for these courses, and the administration will inevitably be called upon for financial support, either for hiring or for paying for released time.

(c) Finally, if the goal of the program is to be policy studies, yet another level of complexity is called for. This may not seem correct, because so many STS programs have policy courses included in them from their inception, but this is only a misleading surface phenomenon. It is possible to describe policy decisions, as in case-study treatments, relevant to the interaction of science, technology, and society. However to study and to model policy formulation requires a substantial complex of courses, students, and faculty converging on policy studies as the apex of a broad range of preparatory work. It is likely that only a small number of institutions could fruitfully make policy studies the goal of an STS program, although many would probably like to do so.

II. One of the major attractions of an STS program is its essentially interdisciplinary character. It is widely supposed that an STS program will, in a natural way, bring together people with diverse, specialized backgrounds, in order to focus on real-world problems whose solutions demand expertise that crosses disciplinary lines. Unfortunately, very little thought is given to what disciplines are, to what the characteristic biases of disciplinary training are, or to how people from different disciplines are to constructively complement one another in a classroom situation. The evidence plainly suggests that it cannot be taken for granted that compresence leads to constructive interaction. The same faculty who are, from bitter experience, immensely skeptical of the value of committee meetings will often agree to teach by committee meeting.

Having one faculty member range over several disciplines is not likely to be maximally effective (with isolated exceptions, of course), and it can be a very valuable experience for students to witness an interaction between two or three faculty members with dramatically different information in their minds and dramatically different conceptual biases. However, simply placing a faculty "team" in one classroom does not guarantee that such an interaction will take place, and this is certainly true when a dozen faculty troop through the classroom as "guest lecturers," almost always a euphemism for pedagogical chaos.

In short, team teaching needs careful preparation, not the least part of which calls for recognition of the role played by ego in aiding or obstructing productive exchanges between faculty in full view of a student audience. Syllabi have to be much more carefully planned when more than one faculty member is involved in a course, and this planning, too, must overcome the common unwillingness of professionals to be critical of one another, in the presence of one another.

III. Most, if not all, STS programs trace their origin to the sparks generated by C. P. Snow's "Two Cultures" talk. I, personally, do not accept Snow's distinction as being between two cultures. I agree that there is a general and profound ignorance of the conceptual content of science and mathematics among humanists. Because of this, humanists pursue their studies in isolation from material that could profoundly influence the course of their thinking by correlating value developments as expressed in art, philosophy, literature, politics, and religion with developments in science, mathematics, and technology. At the same time, while scientists may be more open to humanistic studies than humanists are to scientific studies, it is my experience that they grossly underestimate the sophistication of humanistic learning. Because the materials generated by humanist scholars are superficially more accessible, being couched in what appears to be ordinary language, than are scientific and mathematical materials couched in heavily esoteric symbolic languages, scientists think they can easily penetrate them and extract what is significant. This rarely turns out to be the case. Frequently scientists initially reject as vacuous humanistic materials that they have read without at all understanding them, because they are unaware of the intended meanings of the terms employed and of the density of the language.

This underestimation of the sophistication of the humanities is, I would wager, commonly manifested when physical scientists co-teach courses with humanists, and display an initial pejorative judgement of some work in philosophy, history, or literary criticism that they later reverse or at least qualify. It is no less necessary for scientists than for humanists that an effort must be made to enter into the language and the logic of the materials they engage.

So much for the practical problem of implementing an STS program. There is, in addition, a theoretical problem whose reflection on the plane of practice runs through all three of the goal-levels discussed above. This problem results from parallel judgements by scientists and humanists of the ultimate value of scientific and humanistic study. A recent article by Richard Wear (Chronicle of Higher Education, Sept. 12, 1977) equating science, technology, and their minions with the ancient Carthaginians, embodies this problem in a neat way. According to Wear (and the truth of the characterization is irrelevant to the line of reasoning) the Carthaginians had "little aptitude for art," probably no more for literature, and were interested only in a "share of available business and the right to what they considered their portion of the sea lanes." The ineluctable imperialism of these cultural Troglodites was manifest in the progressive increase in the size of the share of business and of the sea lanes that they forcefully claimed as rightfully theirs.

New Carthaginians, Wear warns, are abroad in the land: the agents of science and technology. They, too, are cultural Troglodites, obsessed by the urge to "do business" and insistent upon a free hand to do so. They, too, are ineluctably imperialistic, as manifested by their aggrandizement of all of nature and all of human behavior as within their purview or subordinate to their own interests.

To Professor Wear, the pivot-point of human being in the world is character, and it is precisely this dimension of the human condition that science and technology expel from serious consideration. Thus, in the domain of education, what is utterly ignored by courses in science and technology is precisely what the humanists assert as pivotal: educing one's character, the better to know one's self and thus to consciously realize one's self. To the extent that courses and programs in science and engineering dominate academic life, to the extent (horribile dictu) that courses in social science and the humanities are reshaped into simulacra of "hard-headed" physical science courses, the perennially human is being sacrificed to evanescent technique.

The published responses to Wear's article were as passionate and as heartfelt as the article itself, but they missed the central point of the argument. That argument reflects the judgement that science and technology are not humanistic activities, are in an essential sense not human enterprises. John Karakash, Dean of the College of Engineering and Physical Science at Lehigh University, has long used a metaphor that goes to the very heart of the problem manifested by this judgement, a problem that can undermine any attempt at an honest exploration of the interaction between science, technology and society. Karakash has on many occasions spoken of the study of nature as the study of Mankind's "Second Constitution," one that must complement the "First Constitution" articulated in the humanistic disciplines if we are to have a complete perception of the human condition. Where the "First Constitution" unfolds human being from the inside, as it were, the "Second Constitution" reveals to Man the options he does and does not have in constructing relationships with the outside world in which our persons are located. An exclusive concentration on the former would be like possessing form without substance, thus without a medium for bringing the form to realization. An exclusive concentration on the latter would be like possessing substance without form, a vacuous mastery of technique with no purpose for which the technique can serve as a means of realization. It has been Karakash's great disappointment that humanists have so frequently failed to broaden his students' perception of the human condition. This failure seems to me clearly attributable to the profound ignorance of the "Second Constitution" of Mankind that permeates humanistic scholarship. There is considerable evidence that humanistic sophistication --poetic, artistic, musical sensitivity-- is not incompatible with wickedness, and it is manifestly the case that a narrowly humanistic education can yield a viciously distorted perception of Man, no less than of nature. What the times, and every STS program, call for is a recognition that a non-trivial familiarity with the conceptual content of the sciences, and the logic and value structure of technology, be part of the mental equipment of every educated person. It is not only the case that portraying science and engineering as activities set over against the essentially human makes it difficult to cope with science and technology in human terms. It is also false to portray them in this way. "Technology" is not a name for machinery. It is a name for a social phenomenon in which people and machines enter as interdependent contributory elements. So, too, scientific knowledge, as is becoming ever clearer as history and philosophy of science advance as disciplines, is not the autonomous product of logico-methodological inquiries. Scientific knowledge is as fully embedded in the cultural matrix in which it is generated, is as essentially expressive of Man working on himself, as are art, philosophy, politics, and religion.

The single greatest obstacle to successfully realizing an STS program then, may well be the insidious (because thoughtless) perpetuation of the portrayal of science and technology as standing outside the sphere of authentically human activities. I believe that aid in overturning this portrayal will readily be forthcoming from science and engineering, but only if it is equally forthcoming from the humanities, and there the impediment may well be a visceral fear of being locked out of the "secrets" of science by the esoteric language in which those "secrets" are cast. The crucial first step in effecting a common ground must, in my view, come from humanists, willing to make the personal commitment to enter into the content of science and technology and to explain their own esoteric language (the dense, professional language of their papers, talks, articles and books) to the scientists and engineers.

Steven Louis Goldman
Lehigh University

WORLD FUTURES STUDIES: INTO THE ABYSS?

Over the past decade, there has been a remarkable shift in the study of international relations. Traditional historical and socio-political concerns have been supplemented by what might be defined loosely as problems of global political economy: population, food, energy sources, raw materials, the environment, and so on. Alongside the more conventional effort to study past and present trends in these areas, a somewhat less orthodox interest in pursuing these trends into the future has developed. Thus has appeared on the academic horizon a new specialization within the international relations discipline: world futures studies.

The concept is suspect right from the start, because it is well known that the "future" cannot be analyzed for the simple reason that it does not yet exist. It follows, then, that any attempt to "study" the future, however well intentioned, must be a species of academic charlatanism. Nonetheless, after World War II a number of scholars who took the study of the future seriously emerged in Europe and the United States. As their work became better known, and as the problems facing the international community grew ever more acute, the future emerged as a respectable field of intellectual inquiry. To be more precise, what was studied was not the future as such, for it still remains beyond the reach of our most sophisticated sciences, but rather alternative futures that could be hypothesized with varying degrees of confidence. The goal was not to determine with final certainty what was going to happen in the future, but only, given contemporary trends, what might happen, or, more ambitiously, what appeared likely to take place.

To futurists, the future can be compared to a fan, with each of its numerous ribs indicating possible lines of development. Here agreement ends, however, for practitioners in the field have split into optimists and pessimists. The latter, represented by the Club of Rome study (although now modified somewhat), fear that the present course of global development will lead inevitably to ecological suicide. The former, as embodied in the Hudson Institute, discount the prophets of doom, and predict an essentially benign future for mankind. Thus, the issue is joined.

It was in an attempt to resolve this conflict in my own mind that I took up the study of the future. As I have had a rather specialized training in Chinese history, politics, and foreign policy, the contemplation of global futures was decidedly a new experience for me. Much of the stimulus to branch out in this unfamiliar terrain was provided by the academic environment at Lehigh University. During my first few months at Lehigh, I met (and even had to converse with!) more individuals concerned with scientific, engineering, economic, and business issues than I had encountered in my own decadal progression from B.A. to M.A. to Ph.D. The time was thus ripe, I thought, to take the plunge into the vast sea of ignorance my own education had left in its wake.

Basing myself on the timeless maxim that the best way to learn is to teach, I set about constructing a "High Immediate Relevancy" course which would be offered on an experimental basis. HIR 98 thus appeared on the roster of temporary courses under the all-embracing title, "Alternative World Futures." I plunged into reading, assembled my texts, put together a syllabus, and was well pleased when some 35 students signed up for the course in the spring of 1977. During the following months I acquired a set of experiences that might be of interest to others possibly tottering on the brink of the ultimate academic abyss: offering a course for which one has not been prepared by one's own education. Caveat emptor!

Let me make a few preliminary observations regarding the students who took the course. They represented a good mix of

"Lehigh types," namely, engineers, business majors, and those from the Arts College. It soon became apparent that this particular blend of students was much more than statistical; it was attitudinal as well. In general, the engineers took a resolutely optimistic position on the transforming qualities of science and technology. The humanists, on the other hand, constantly voiced their suspicion, if not downright hostility, to the ways in which science and technology are changing the world in which we live. As for the budding executives, they adopted a more equivocal stance, although, as a group, they tended to lean toward a kind of crossed-fingers optimism. At one point in the course, during a simulation of the Supersonic Transport (SST) controversy of the early 1970s, the engineers and humanists almost came to blows, with the business types forced into a quasi-brokering position. C.P. Snow would be disappointed: his "two cultures" are alive and well, and flourishing on the Lehigh campus. (Clearly, our work is cut out!)

I have appended a copy of the course syllabus for those interested in the topics covered, but a few comments are in order here. The first three weeks were devoted to familiarizing the students with the general field of future studies, with special attention devoted to international relations, the impact of science and technology, and the various methods of forecasting in common use. Having established this basis, I then moved on to a consideration of several selected areas of current concern in thinking of the world in the future. Some of these subjects were basically "sociological" in nature (e.g., population growth, governmental systems, and nuclear war), while others were more "technological" (e.g., economic production, food, resources, energy, and the environment). At this stage, it became clear to both the students and myself that we were dealing with a highly multidisciplinary subject, drawing extensively from humanistic and scientific fields of knowledge. Nevertheless, by the midway point in the course we had acquired a basic grasp of major trends in these selected areas, and were at least aware of the magnitude of the problems currently facing humanity.

We then turned from the measurement of current world trends to a consideration of various approaches that have been adopted in conceptualizing alternative future scenarios. Of a vast array of approaches, I selected four of particular relevance to world politics: utopianism, regionalism, world order studies, and Marxism. (Some attention was given to science fiction as a conceptualizing tool for future worlds, but this was not developed to any great extent.) After going through this highly normative and/or speculative literature, the students were assigned a specific task which would enable them to utilize their understanding gained thus far. They were asked to read, discuss in class, and write a critique of one of the best known examples of current speculation, namely, W. Warren Wagar's Building the City of Man (Outlines of a World Civilization). Wagar, whatever his faults, has the virtue of stimulating and irritating the reader at the same time, so he provided the students with ample material to work out their own ideas in the course of criticizing Wagar's. I then wrapped up the course with some consideration of the difficult problem of establishing our own priorities in thinking of alternative world futures, and devising transition strategies to get us from here to there.

Texts for the course presented something of a problem, for the field is relatively new and coverage correspondingly spotty. After some comparison, I decided upon four basic volumes which provided a wide coverage of both writers and ideas in the field. Alvin Toffler's The Futurists is an excellent anthology of short selections from prominenti ranging from Buckminster Fuller to Marshall McLuhan, and gives good coverage of both socio-economic and scientific issues. Herman Kahn's latest book, The Next 200 Years (A Scenario for America and the World) provides a highly readable treatment of many of the major problems the world is facing, and affirms the ability of science and technology to solve them. Louis Beres and Harry Targ give a very useful survey of major approaches to thinking about the future in their recent volume, Reordering the Planet (Constructing Alternative World Futures). Taken in conjunction with Warren Wagar's more speculative (and somewhat pessimistic) essay mentioned above, these books give the student a decent introduction to the general field of alternative world futures. None of them are tailored precisely to an international relations perspective, but they come close enough, and can be supplemented by other materials.

This brings me to the next problem I would like to consider, namely, the teaching methodology employed in the course. Because of my own rudimentary grasp of the subject, and in a conscious attempt at innovation, I kept formal lectures to a minimum. Rather, I tried to accommodate the multidisciplinary scope of the course by relying extensively on audio-visual teaching materials. A good working collection of these aids has been accumulated by the Humanities Perspectives on Technology and other programs at Lehigh. They included xeroxed handouts, wall charts, audio tapes, filmstrips and slides, and 16mm films. In general, I found these materials satisfactory, although they are not very susceptible to manipulation according to the personal interests of the instructor. One major problem is that of level, for the high investment involved in audio-visual materials necessitates that they have a very broad appeal. Consequently, their intellectual level is somewhere between senior high school and freshman college, and this is really not good enough in the Lehigh context. A few of the materials, such as Marshall Windmiller's filmstrip, The Giant and the Dwarf (India's Green Revolution), is clearly an exception, for it effectively combines an interesting audio-visual presentation with more substantial intellectual content than is common. Other aids, especially taped interviews with well-known experts in technical fields, make little attempt to present their material in a well-organized and interesting format. Thus, their higher intellectual appeal is often lost on the student, who is turned off by the failure in presentation. As I said, I found the experience with audio-visual materials generally satisfactory, but they are still in a rather primitive state at the present time. Clearly, some useful work could be done in this area, at least as it pertains to world futures studies.

In my desire to break with the lecture format, I decided to experiment with some gaming, or, more ambitiously, simulation exercises. An attempt to use the Delphi method of forecasting in the classroom was not too successful, but in another area I was well pleased with the results. This concerned the SST simulation mentioned previously, in which the engineers and the arts students almost came to blows over the merits of the American SST, the Anglo-French Concorde, and similar machines. Drawing on some material prepared by the Newsweek Educational Program in their audio-visual kit, 2000 A.D., I divided the class into three sections. Two equally sized groups (self-selected by previous persuasion) represented the pro-SST and the anti-SST lobbies respectively. A third group, who expressed no strong feelings one way or the other, were appointed to serve as members of Congress. After all the parties had briefed themselves on the basic facts and issues involved, the pro and anti lobbies were given time to state their cases to the legislators, who had the power to approve or reject federal funding of the SST project. The experiment was a great success, with everyone eagerly reading the material, and, in the case of the lobbyists, coordinating a common strategy to place before Congress. As it turned out, this simulation reflected the actual decision taken in 1971, for the SST was (I cannot avoid a pun) "shot down" by the classroom Congress. Like their real-life counterparts, they were not persuaded that the potential of the SST outweighed the financial costs involved, or the inherent environmental problems it might raise. The students were quite clearly both informed and stimulated in the course of the exercise, and this was of some gratification to me.

Finally, a few words must be said about evaluation in the course. As for the students, they had their work cut out for them, for in addition to oral reports in class (based on readings from the texts), they were asked to take two separate multiple-choice/short identification term tests worth 50 per cent of their final grade. The other 50 per cent was based on their 12-15 page critique of Wagar's book, and this proved a little troublesome for some of the engineering students, who in general outperformed the arts and business students on the term tests. Nonetheless, the fact-based tests combined with the critical papers gave every student a fair chance to deal with the material, and the final results were generally representative of the abilities and efforts of those involved.

As for the instructor, he was not examined quite so rigorously, although the strengths and weaknesses of the course became apparent as the weeks wore on. My efforts to weld the very disparate material into a consistent international relations framework were not completely successful, with the result that the course sometimes lacked adequate focus. Also, the more scientifically oriented students sensed that I was sometimes (perhaps often) out of my depth whenever complicated scientific or technical subjects were discussed. There was also a general failure to integrate the many audio-visual materials effectively with the more traditional teaching methods in the course, and this led to some degree of discontinuity in the classroom presentations. Finally, I attempted to cover too much material in one semester, with a resulting sense of superficiality in certain of the lectures and group discussions. Some of these problems could perhaps be solved, or at least mitigated, by a team approach to teaching the course, but this might introduce equally difficult problems of coordination and cooperation. Still, it remains a thought for next time.

Was "Alternative World Futures" a success? I think, given the qualifications above, that it was. It provided me with a structured format within which to delve into a new and highly interdisciplinary approach within my own academic discipline. At the same time, it brought together a diverse group of students for the purpose of exploring in a systematic manner a broad range of questions which were immediately relevant to them all. It exposed the more technical students to difficult normative and socio-economic considerations in thinking about present world trends and future possibilities. At the same time, it forced those in the humanities to face squarely a number of areas of concern in which some degree of scientific and technological understanding (however minimal) is essential. Allowing for the difference between reach and grasp, the course encouraged everyone to "think big," and to explore broad global problems in multiple time frames from an integrated socio-technical perspective.

In sum, the study of the future in the universities has an appeal that students can scarcely resist. The past is obviously beyond their control, and they are not yet ready, either emotionally or professionally, to deal confidently with the present. The future, then, is a time dimension which is of considerable interest and refleance to them, and it would be well for educators to take this into account. In the universities, then, the study of the future has a great future from a scientific and humanistic perspective, for it combines the undeniable virtues of both. Can I risk a prediction? The study of the future is here to stay, and it will become a major academic focus in the universities during the next decade. (Barring the unforeseen, of course!)

Ray Wylie
Dept. of International Relations
Lehigh University

ALTERNATIVE WORLD FUTURES

PART I: World Politics and World Futures

1. The Study of the Future
2. Science, Technology, and Charge
3. Methods of Futures Research

PART II: Contemporary World Trends

4. Towards a New Leviathan?
5. The Spectre of Global War
6. Population and Food
7. Energy and Raw Materials
8. The Total Environment

PART III: Approaches to the Future

9. Utopianism (and Science Fiction)
10. Experiments in Regionalism
11. World Order Approaches
12. The Marxist Vision

PART IV: Transition to the Future

13. Wagar's "City of Man"
14. Priorities and Strategies

A FEW RECENT SOURCES ON ALTERNATIVE WORLD FUTURES

1. Beres, Louis Rene and Targ, Harry R., Reordering the Planet (Constructing Alternative World Futures), Boston: Allyn & Bacon, 1974. A good historical introduction.
2. Falk, Richard A., A Study of Future Worlds, New York: Free Press, 1975. A substantial example of the World Order Models Project of the Institute for World Order.
3. Futures (UK, bimonthly). A serious journal of forecasting and futures research.
4. The Futurist (USA, bimonthly). A semi-popular journal of the World Future Society.
5. Kahn, Herman, et al., The Next 200 Years (A Scenario for America and the World), New York: William Morrow, 1976. An optimistic appraisal of world resources.
6. Marien, Michael, Societal Directions and Alternatives (A Critical Guide to the Literature) LaFayette, N.Y.: Information for Policy Research, 1976. A comprehensive annotated bibliography.
7. Meadows, Donnella H., The Limits to Growth, New York: Universe Books, 1972. A well-known pessimistic projection of world resources.
8. Newsweek, Inc.: 2000 A.D., New York: Newsweek Educational Program, 1975. An introductory audio-visual kit on the future, supplemented by useful printed materials.
9. Somit, Albert, ed., Political Science and the Study of the Future, New York: Holt, Rinehart & Winston, 1974. A useful collection of scholarly papers.
10. Toffler, Alvin, Future Shock, New York: Random House, 1970. A popular best-seller.
11. Toffler, Alvin, ed., The Futurists, New York: Random House, 1972. An interesting sample of the literature.
12. Wagar, W. Warren, Building the City of Man (Outlines of a World Civilisation), New York: Grossman Publishers, 1971. A provoking speculative essay.
13. Windmiller, Marshall, The Giant and the Dwarf (India's Green Revolution), Culver City, Calif.: Zenger Productions, Inc., 1974. One of the few filmstrips (with commentary) that combines substantial intellectual content with an interesting audio-visual presentation.

In response to our call for concise introductions to major figures in the field of science, technology, and society (see HPT Curriculum News #1, August 1977) we received the following article on Martin Heidegger. Anyone desiring to contribute an introduction to people such as Ellul, McLuhan, Mumford, Reich, Dubos, or others should contact the Editor.

A BRIEF INTRODUCTION TO HEIDEGGER'S CONCEPT OF TECHNOLOGY

Martin Heidegger, who died last year at the age of 86, was one of the most important European thinkers of the twentieth century. However, because of the lack of translation of certain crucial works, Americans have been relatively uninformed about his important contributions to our understanding of the nature of technology. With the publication this fall of Heidegger's The Question Concerning Technology and Other Essays, excellently translated by William Lovitt, and David Krell's collection, Martin Heidegger: Basic Writings (both published by Harper & Row), the translation gap is being bridged at last. In this little essay, I can hope only to point out some of the predominant themes in Heidegger's richly rewarding interpretation of the nature of technology.

First of all, Heidegger's term for technology is Technik, which he uses to refer neither to the totality of mechanical-electronic devices, nor to the application of science to practical problems. Instead, he claims Technik is the understanding of all things as manipulable, calculable, quantifiable raw material; all things are revealed as mere objects, valuable only insofar as they contribute to the enhancement of the power of the self-certain human Subject. If one fails to make this distinction between Technik as the understanding of the Being of beings as raw material, and "technology" as modern mechanical devices, etc., one will never grasp Heidegger's point. To see what Heidegger means by Technik requires a brief review of what he means by Being, time, history, and nihilism.

For Heidegger, Being does not refer to some mysterious entity or thing (such as God), which is somehow the ultimate "ground" or "basis" for all reality. Instead, Being refers to the particular way in which beings present themselves or manifest themselves to us in different historical epochs. For the Greeks, beings presented themselves as what stands forth and emerges into presence; to be meant to be present. For Plato, of course, what was most permanently present were the unchanging "forms," which were thus the highest instance of what it meant to be. For medieval man, what is permanently present is God, upon whose constant presence depends the presence(Being) of all the creatures in the Universe. God came to be named Supreme Being, because he was taken to be the "basis" for the Being of everything else. However, for modern man beings present themselves to us as calculable, exploitable raw material or objects to be used at will for our own purposes. For us, to be means to be re-presented, or transformed and re-arranged, according to our desires and projects. To understand in this way what it means to be, is what Heidegger calls Technik.

Evidently, there is some connection between presence and Being, i.e., there is some relation between a particular dimension of time (the present) and Being. Heidegger wrote Being and Time (1927) to try to work out this obscure connection. In that book, he claimed that we can understand what things are (we can understand the Being of beings) because we exist in such a way to open up a temporal-historical "horizon" or "clearing" within which beings can present themselves, or in which they can be present. Heidegger here talks much like Kant, who said that time is the pure form of intuition, which is the horizon necessary for all of our representations; all human experience must take place within time. Without this temporality to provide the "clearing" in which beings can be present, then Being does not "give itself." That is, if no people are around any longer, the planets and stars would continue their activity, but they would not be present for understanding. To be is to be somehow present within the horizon of temporality. For Heidegger, "objective" time derives from the fundamental temporality of human existence; without man, time is not. As history unfolds itself, our experience of temporality apparently changes, for our understanding of the Being of beings changes. The history of the West is the history of the different ways in which beings "present" themselves to us. It is very important to see that, for Heidegger, man is *not* responsible for these alterations in the way in which beings *present* themselves, or *are*. Hence, history is not in man's power to control; we are the subject of *destiny*.

With the emergence of the scientific world-view at the dawn of the modern age, beings no longer presented themselves as creatures of God, but as quantifiable, mathematically comprehensible (and thus controllable), intrinsically valueless *objects*. Descartes introduced the distinction between the self-certain Subject and the mathematically knowable object. The Subject (*ego cogito*) is certain of its own existence, and this self-certainty becomes the standard against which to measure the knowledge and reality of everything else. Whatever *is* must be knowable with the same certainty as the self-certain Subject knows itself. Hence, only the mathematically knowable really *is*, for only the mathematical approaches the Subject's rigorous standard of certainty. Descartes thus helps initiate the Enlightenment, the age of human autonomy; man's rationality becomes the ultimate tribunal for the judgment about truth and Being.

To understand beings as mere objects and, thus, Being as "objectivity" is to "re-present" (*vor-stellen*) them, or to *set* them *before* the calculative gaze of the Subject. Once again, the temporal dimension of the present determines the Being of beings. Heidegger uses the word "*Ge-stell*" or "enframing" to describe the fact that, for modern man, *to be* means *to be set up* (*vor-gestellt*), re-presented, re-arranged, re-structured, trans-formed to meet the needs of the Subject. Thus, for us the Rhine River *presents* itself as trans-formable (by dams, etc.) into energy. For Heidegger, modern mathematical science is grounded in *Technik*, the understanding of beings as objects for the calculating Subject. Much like Heidegger, Herbert Marcuse regards modern science as *intrinsically* instrumental, *essentially* geared to the domination of all natural objects. Thus, *Technik* makes possible the mathematical world-view, which eventually permits the rise of the machine technology which lets man set into *practice* the drive for conquest which hitherto had rested in scientific *theory*.

This new way of understanding man as the self-certain Subject and Nature as the re-presentable object whose only value is what man accords it culminates in the philosophy of Hegel, who asserts that man is the self-actualization of God. For Hegel, man becomes the center of all things; history is the process by which Spirit overcomes its alienation or estrangement from Nature by recognizing itself (as rationality) in Nature. Man becomes God because man is the place in which this achievement of absolute self-consciousness occurs. Marx makes Hegel "walk right side up" by saying that man, not God, is the subject of history. The conquest of Nature, which for Hegel occurs in the form of *knowledge*, must for Marx be executed in practice if man is to realize the goal of all history: man's freedom as a pure productive being. Thus, for Marx, technology is the machinery necessary to free man from scarcity so that man can realize his own creative essence, but for Heidegger, Marx remains part of the subjectivistic, man-centered Western tradition which tends to regard Nature as an instrument for man's Will. Heidegger regards both socialism and capitalism as alternative expressions of the same subjectivistic drive for domination over Nature and man.

Nietzsche brings this subjectivism to its furthest unfolding, when he asserts that everything is the Will to Power. Heidegger views Nietzsche's "Overman"--the highest form of the Will to Power--as the expression of man's drive for planetary domination. When Nietzsche said that "God is dead," he meant that the age of Nihilism had come. In the place of the transcendent God, there steps man. The World Wars of this century testify (in Heidegger's view) to the results which accompany the reduction of the "good" to whatever the powerful nation-states *assert* is good. If man is the measure of all things, if there is nothing transcendent against which to measure human deeds, then the Will to Power overwhelms all other "values."

For Heidegger, the real threat to man is not merely physical destruction, although that possibility grows as the quest for power produces ever greater instruments for self-annihilation. The real threat is that man will cease to be aware of his real "calling," viz., to be the "clearing" or "site" for the manifestation of what is. Far from being self-grounding, man is *gifted* with the ability to understand the Being of beings, to marvel at what is here with us, to gain a sense of things. By asserting himself to be the center and meaning of everything, man conceals his essential indebtedness to what transcends him, viz., the cosmic play which continually *presents* what is in new ways. Because this cosmic play is transcendent, man himself has no real control over history; our current fate is for Being to present itself in such a way that the technological world results. Because Being presents itself as exploitable raw material, man acts to appropriate and dominate what is. Man is in need of a new understanding of Being, a "releasement" from the Will to Power, so he can assume his proper role as the "shepherd" of what is, instead of as the ruthless master. Heidegger offers little practical advice for finding our way out of the technological-ecological nightmare in which we find ourselves; he urges only that we prepare ourselves as best we can to hearken to a new way of understanding what is. As he said in 1966, "Only a God can save us now."

There are important criticisms of Heidegger's views. From the Marxist perspective, Heidegger is a reactionary, for he suggests: 1) that man is not the real subject of history; 2) that the world changes as the result of a new kind of *thinking*, whereas, in fact, human *acting* is the real motor of history; 3) that the scientific-technological progress is *inherently* destructive of man's essence, whereas, in fact, technological progress is the great *liberator* of mankind. Technology *seems* destructive only because of its misuse by capitalism. By saying that man's fate is in the hands of God, Heidegger recommends a quietism which negates the importance of *praxis* designed to transform technological instruments into the benefactors of all mankind, instead of a particular *class* of men. Heidegger's reply would be that human alienation will never be overcome until man is shown that he is *not* the center of all things. Marx simply reshuffles the existing deck, when he says that the technological transformation of Nature must be for the benefit of all instead of just a few. For Heidegger, what is required is an end to "humanism," defined as that attitude which makes man the ultimate meaning of history. We need to pass beyond humanism, in order to comprehend that history is the unfolding of a cosmic spectacle of which man is but a crucial element.

Michael E. Zimmerman
Dept. of Philosophy
Tulane University

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__________, *The End of Philosophy*, translated by Joan Stambaugh (New York: Harper & Row, 1973).

__________, Poetry, Language, Thought, translated by Albert Hofstadter (New York: Harper & Row, 1971). Cf. especially the essay, "What Are Poets For?"

Hwa Yol Jung, "The Paradox of Man and Nature: Reflections on Man's Ecological Predicament," The Centennial Review, XVIII (Winter, 1974), pp. 1-28.

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Otto Pöggeler, "Being as Appropriation," translated by Ruediger Hermann Grimm, Philosophy Today, XIX (Summer, 1975), pp. 152-178.

George Sessions, "Anthropocentrism and the Environmental Crisis," The Humboldt Journal of Social Relations, II (Fall/Winter, 1974), pp. 1-12.

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SYMPOSIUM ON
TEACHING THE HISTORY OF SCIENCE

The Committee on Undergraduate Education of the History of Science Society will sponsor a symposium at the Society's annual meeting in Dallas, Texas, Thursday, December 29, 4-6 p.m. The symposium is titled "Strategies of Undergraduate Instruction" and should be of special interest to those who will be teaching courses involving the history of biology and medicine or the social aspects of science. The speakers will discuss their own experiences in teaching such courses and materials they have found useful.

Co-chairmen and organizers of the symposium are Arthur Donovan (West Virginia University) and Maurice Finocchiaro (University of Nevada at Las Vegas). Speakers will be:

Sheldon J. Kopperl (Grand Valley State Colleges), "Madness or Salvation: A Course on the History of Genetic Recombination"

Stanislaus Dundon (California Polytechnic State University), "The Lure of the Human and Social Dimensions in the History of Science"

Lois Magner (Purdue University), "Magic and Medicine: An Introduction to the History of Medicine"

Nathan Sivin (University of Pennsylvania) will comment on these papers and speak briefly about his course on medicine in China.

Following the symposium (held in the Hotel Adolphus), there will be an open dinner meeting of the Committee on Undergraduate Education to plan activities for the coming year. Anyone interested in attending this meeting should contact the chairman in advance so adequate space can be reserved.

Stephen G. Brush, Chairman, CUE
Dept. of History and Institute for
Physical Science and Technology
University of Maryland
College Park, MD 20742
301/454-2723

TWO AUDIO-VISUAL SETS

The Industrial Revolution (1970).
Educational Audio Visual, Inc.,
Pleasantville, New York

Contains 186 slides on 2 filmstrips, script booklet, 2 cassette tapes. Time: one hour. Cost: $38.00. (Also available with 2 LP's instead of cassette tapes. Cost: $27.00)

The intention of this package is to stimulate debate about the process and repercussions of rapid industrial growth by examining the English experience during the eighteenth and nineteenth centuries. Part I, "The Coming of the Revolution" (27 mins.), considers the causes and social consequences of the initial industrial spurt in the cotton industry after 1780. Part II, "Industrialism and Social Change" (31 mins.), deals with similar aspects of the growth of the iron industry and traces its more profound impact on the economy as a whole, particularly after the construction of the railway network in the 1830s and 1840s. A brief epilogue describes the second industrial revolution, the development of mass production and the assumption of industrial leadership by Germany and the United States.

This is certainly an entertaining and lively account. Throughout, the commentary is excellently illustrated by contemporary cartoons, drawings, paintings and prints, and by photographs of machinery and industrial sites; it is also punctuated by enthusiastic (if repetitious) renditions of songs and ballads of the industrial revolution.

However, the value of the production is seriously diminished by a dogmatic script which ignores much of the relevant historical literature and raises few questions which might promote fruitful discussion by university students. At the general level, for example, a more detailed definition of the industrial revolution seems appropriate as does a reference to the debate about the 'leading sector' theory. More specifically, one would like a discussion of the validity of starting the revolution in 1780 and a more comprehensive account of its origins. These lay, we are told, in three eighteenth-century preconditions: the existence of a large reservoir of non-agricultural labor, produced by the agricultural revolution and by an autonomous growth of population; the unique willingness of the politically-dominant landowning class to engage in industrial enterprise and to foster Britain's trading interests; and the availability of expanding domestic and overseas markets for manufactured goods. In these circumstances, it is argued, the coincidence of abundant raw material in the New World and revolutionary technological change propelled the cotton industry onto a course of unprecedented growth.

The commentary ignores the contributions of such (admittedly controversial) factors as capital formation, financial institutions, credit mechanisms, harvest conditions, laissez-faire, law, religion, science, the social structure, and the French Revolutionary and Napoleonic Wars. It also makes no attempt to explain the sources of inventions and the wealth of entrepreneurial talent which, presumably, was responsible for their application and diffusion. A similar criticism can be levelled at the uniformly pessimistic interpretation of the social consequences of industrialization. This contains no reference to the ongoing standard of living debate and fails to place its judgments in perspective by describing, for example, living conditions in the eighteenth century (which, by implication, emerges as a Golden Age) and the fate of non-industrial Ireland during the 1840s. It is true, of course, that such a sweeping survey can only treat the subject broadly. However, by reducing the time devoted to songs, the commentary could quite easily have presented a more balanced picture and introduced at least some of the more important historical controversies.

Unfortunately, the script also contains a remarkable number of careless inaccuracies. It resurrects the long-demolished myth that the enclosure movement created a rural proletariat ripe for industrial exploitation. In addition, we are told that, in the 1750s, British trade "did not yet involve the export of goods manufactured at home;" that Robert Bakewell "first pioneered experiments in intensive breeding;" that Chartism began in the 1820s; that the corn laws were repealed in 1847; that the Factory Act of 1847 "established the important principle of government regulation of industry;" and so on.

I would not recommend the adoption of this program in history courses and feel that its interpretations are too slight to be used profitably in a course on technology and human values. It does provide a satisfactory, general chronology of major industrial and technological developments during the last two centuries and is particularly effective when describing and illustrating the relevant inventions. Thus, if handled cautiously, it might provide a useful introduction at an elementary level.

Ian Duffy
Dept. of History
Lehigh University

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The Scientific Revolution (1974).
Educational Audio Visual, Inc.,
Pleasantville, New York

Contains 242 slides on three filmstrips, script booklet, 2 cassette tapes. Time: approx. 50 minutes. Cost: $60.00. (Also available with 3 LP's instead of cassette tapes. Cost: $54.00)

I don't like this filmstrip. In my opinion, the pictures are largely throwaways and the text is right out of the Neanderthal era of history of science.

In this epic, the "classic" fable is revived of the recovery of Aristotelian science by Medieval Christendom; of its institutionalization at the hands of Thomas Aquinas; of the dead weight it pressed on the minds of the later Middle Ages and Renaissance; and of its heroic overthrow by noble Copernicus, Kepler, Bacon, Descartes, Galileo, Harvey, and Newton. Here, again, progressive science struggles mightily against hopelessly obscurantist religion to articulate for Mankind objective truth. Short of writing an epic of my own in detailed response to what I see as the wrong-headedness of this one, I can only say that I would not show this filmstrip to any high school, let alone college, class. It is riddled with fundamental inaccuracies in its descriptions of the work of individual thinkers -- Plato, Aristotle, Copernicus, and Kepler among them -- ,it gives no feeling whatsoever for possible constructive relationships between science, philosophy and religion, and its interpretations of the conceptual development of science are naive in the extreme.

Bronowski's Ascent of Man (book and film series), far from happy with it though I am, displays at least some feeling for science as a cultural, not a logico-methodological phenomenon. The position reflected in this filmstrip is that science is a linearly advancing inquiry that progressively uncovers the objective nature of the world existing independently of the human mind, an uncovering made possible by the application of an impersonal method to the self-given data of sensory experience. The "truths" generated by this method then radiate out into the surrounding culture, unilaterally forcing modifications of values and institutions.

By contrast, my position (not unique to me, by any means) is that the conceptual development of Western science is intimately coordinated with the development of Western culture and that this coordination is explicitly reflected in Western art, philosophy, religion and politics. To me, the origins of modern science lie, *not* in a seventeenth century "revolution," but in culture-wide value changes in twelfth century and sixteenth century Western Europe whose expression generated the convictions basic to seventeenth century science: that knowledge of Nature was possible and a worthwhile objective; that Nature was epistemologically and ontologically closed; that empirical phenomena were the overt expression of covert but mathematically describable notions; that this covert substructure to experience could be disclosed by an objective method (the experimental method). In this view, the recovery of much of classical nature philosophy was the consequence of an active reaching out by Western society motivated by an autonomous revaluation of Nature, Man, God, and their mutual relationship. Initial reaction to Aristotle was creative, critical, and bold, in principle laying down the foundations for a mathematical approach to physics and a very modern-sounding conventionalist epistemology.

The EAV filmstrip gives no sense of the rich interplay between science, philosophy, religion, art, and politics, for example, an interplay that was mutually influencing in profound ways, as I have attempted to describe in detail elsewhere. Nor is any attempt made to discriminate science from technology or to deal with the form of their social impact. It seems *at best* pointless to expose students to a static treatment of science when so much has been learned, in the last half-century, of its dynamic character as an integral component of Western culture, dialectically embedded in the full matrix of human activities (influencing, and being influenced, in developmentally complex ways).

Steven Goldman
Lehigh University

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While civilization has been improving our houses; it has not equally improved the men who are to inhabit them. ---Thoreau

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

"APPROPRIATE TECHNOLOGY." ISSUE TITLE. *EKISTICS* 43(259), JUNE 1977.

The studies brought together to form this special issue differ widely in methodology and disciplinary background. The opening article analyses recent changes in food distribution patterns in Hong Kong, finding the growing number of supermarkets more impersonal and less convenient, i.e. less "appropriate," than the food hawkers and public market stalls they supplant. The "appropriateness" of the remnants of the colonial education system for training African youth is questioned by another writer in the issue. On a different tack, the results of a study of choices for Tanzanian industrial development are presented. The notions of intermediate technology are applied to the United States in considering such problems as housing and solid waste. Reading through the issue, one does not encounter a uniform meaning assigned to the phrase "appropriate technology," a problem that leads to some confusion. A "primer" on vocabulary, illustrated with case studies, is provided by the Brace Research Institute, but it offers not a unifying, but rather, another differing perspective.

BAZELON, DAVID L. "COPING WITH TECHNOLOGY THROUGH THE LEGAL PROCESS." *CORNELL LAW REVIEW* 62 (5): 817-32, JUNE 1977.

Recognizing that neither the courts nor scientists and technologists have the qualifications and necessary awareness to make "painful value choices" related to technological innovations, Bazelon, the Chief Judge, U. S. Court of Appeals for D. C., eloquently voices his concern over the decision making process. He asks *who* should be participating in the decisions and what procedures should be followed. Recent controversies, e.g. flourocarbons, SST, recombinant DNA, and nuclear breeder reactors, illustrate the necessity for broadened public participation and widely-informed regulatory agencies. Still, the determination of who is most worthy to speak for the public interest is an "extraordinarily difficult" problem. Excellent documentation of court cases and government documents makes this article a superb base from which to design a potentially high-impact course on technology, public policy, and the law.

CARR, MARILYN. *ECONOMICALLY APPROPRIATE TECHNOLOGIES FOR DEVELOPING COUNTRIES; AN ANNOTATED BIBLIOGRAPHY*. LONDON: INTERMEDIATE TECHNOLOGY PUBLICATIONS LTD., 1976.

Commissioned by the Intermediate Technology Publications Group, this selective bibliography covers the "hardware" aspects of the subject. Publications are included which consider technologies related to basic human needs: food production, housing and building materials, food processing, clothing and foot gear, power sources, water supply, health, transport, other manufactured goods, i.e. woven sacks, cigars, soap, buttons, solarcookers. Also included are useful bibliographies, as well as handbooks, manuals, and buyers' guides. Judicious selection, nicely annotated.

FLORMAN, SAMUEL C. "SMALL IS DUBIOUS." HARPER'S, AUGUST, 1977, PP. 10-12.

In this brief critique of E. F. Schumacher and his followers, Florman argues for an eclectic, rather than an "alternative," approach to technological problem-solving and planning. Why, he asks, can not windmills and rooftop solar collectors supplement, rather than supplant larger, more reliable and already existing means of generating power? The choice of technology should be based on efficiency, not on elegance, aesthetic appeal, or the moral predilections of a few scholars.

FOWLES, JIB, "THE PROBLEM OF VALUES IN FUTURES RESEARCH." FUTURES 9 (4): 303-14, AUGUST 1977.

Futurists, forecasters, and planners all operate within individual value frameworks which are necessarily topical and parochial. This leads to the imposition of present attitudes which are likely to be at odds with the values of those who will be subjected to them. Coincidently, options for the future thus tend to be reduced. This "haughtiness" of futurists impinges on futures research in the forms of project plans, goal choices, and forecasting techniques. Three strategies, to be utilized together, may lessen the problem: many guesses about future values should be hazarded, surface values might be manipulated, and plans should be flexible with opportunity for review.

FRANKE, HERBERT W. "A CYBERNETIC APPROACH TO AESTHETICS." LEONARDO 10 (3): 203-6, SUMMER 1977.

The author, a German physicist and artist, employs the term "cybernetic aesthetics" as a joining of information theory and art as a means to evaluate the effectiveness of artworks. He contends that since the human brain is consciously capable of receiving information at the rate of 16 bits (discrete quantities) per second, artists should provide a flow of data at this rate. Compositions can be conceptualized into a series of categories so that each category approximates this rate, but interest is concentrated successively and thus remains for a longer term. If this is achieved, "one might expect feelings to be stimulated that are associated with beauty, harmony."

HOOS, IDA R. "SOME FALLACIES IN FUTURES RESEARCH." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 10(4): 335-44, 1977.

We are deluding ourselves if we assume we have the techniques to study the future rationally and scientifically. "With data the driver, analysis the watchword, quantification the rule, and model building the prime preoccupation," futurology is a construction of systems analysis, cost-benefit analysis, program budgeting, and data collection. These methodologies are laden with manipulation and an emphasis on economic information. Purposeful deception runs rampant. Hoos cites the publication by a Senate Committee of an eight volume record of hearings which were made to appear live but were never held. Forecasting tools are therefore dangerously unreliable.

"HUMAN SETTLEMENTS." ISSUE TITLE: IMPACT OF SCIENCE ON SOCIETY 27(2): APRIL-JUNE 1977.

Studies concentrate on ideas and research useful for predicting and planning the habitats of the future. Stephen Boyden describes an ongoing, comprehensive ecological study that uses dense, diverse Hong Kong as an analytical model. Basing his observations on recent developments in the Soviet Union, Ilya G. Lezhava recommends building habits for the future. The configuration of settlements is strongly influenced by the larger cultural environment. Studies in this issue document the effects of such diverse environments as ancient India and modern electronic communications networks. Concluding papers summarise design alternatives, sketching the ideas of arcology and the "climatological city" of Peter Van Gogh.

KOENIG, H. E. D. "THE TOY THEORY OF WESTERN HISTORY." BULLETIN OF THE ATOMIC SCIENTISTS 33(8): 16-18, OCTOBER 1977.

Our society has underestimated the human motivation to "play with toys"--the desire to manipulate novel and high-performance devices. The large military complex is a rationalization of the need of our technophiles to play with the "hottest" new machines; however, the perceptible trend toward non-military application of technology has been caused by three factors: the introduction of dehumanised nuclear weapons where those involved have little opportunity to "practice," NASA's spectaculars where a Saturn V provides "visceral thrill" for millions, and, most importantly, the introduction of the computer. In contrast to guns and planes where the toy extends the self, the fascination with the computer lies in what one puts into it. (All we need is a computer with the macho of a Peterbilt. Well, is not the calculator replacing the motorcycle helmet and leather jacket--or even the keys to the car?)

"MEDIA AND CULTURE." ISSUE TITLE: ET CETERA 34(2): JUNE 1977.

An invigorating special issue. The media's role in pushing politicians from the smoky "back-region" to the floodlighted "middle region" is traced in a lively contribution by Joshua Meyrowitz. Two papers in the issue review findings on the social effects of television. One considers its role as a leveler of experience, a convenient and congenial time-waster; both agree that evidence continues to suggest a strong relationship between heavy exposure to violent programming and anxious, distrustful and violent behavior. Philosophical essays, a bit of McLuhan, and a satirical piece on intimate inanimate objects round out the issue.

MISTICHELLI, JUDITH AND CHRISTINE ROYSDON. BEYOND TECHNICS: HUMANISTIC INTERACTIONS WITH TECHNOLOGY. A BASIC COLLECTION GUIDE. HUMANITIES PERSPECTIVES ON TECHNOLOGY, LEHIGH UNIVERSITY, 1977. 63p.

Highly annotated guide to the 100+ books which provide the most significant statements resulting from considerations of technology from humanistic points of view. The bibliography attempts to provide the researcher or teacher new to the field with a basis both for an understanding of treatments of the issues to date and for an investigation of the relevant scholarship in various disciplines. Overviews, anthologies, historical and case studies are chosen, plus interactive studies of technology with art, literary criticism, fiction, science fiction, poetry, social impact, technology assessment, philosophy and ethics. Major interdisciplinary journals are also described.

MORRIS, BERTRAM. "THE CONTEXT OF TECHNOLOGY" TECHNOLOGY AND CULTURE 18(3): 395-418, JULY 1977.

In primitive societies, Morris writes, technology exists to support life-giving activities. Supported by myth and ritual, which appeal to supernatural aid for skill and success for such activities, technology is central to cultural form. In contrast, technology and science in an industrial society are set in the context of a political system that controls the distribution of power and wealth. In such a context, technology no longer lends direct support to life. Morris laments this change, exhorting that technology must be transformed into "an organ mediating science and industry which negates the spurious culture that embraces the ideology of special interests and which affirms a genuine culture that espouses the philosophy of the common interest."

WINNER, LANGDON. AUTONOMOUS TECHNOLOGY: TECHNICS-OUT-OF-CONTROL AS A THEME IN POLITICAL THOUGHT. CAMBRIDGE: MIT PRESS, 1977.

Rather than a sequential "march of progress," technological change is seen as "a variety of currents of innovation moving in a number of directions toward highly uncertain destinations." Because of this lack of coherence, contemporary technology cannot be comprehended nor can its future be predicted. The rational, task-orientation of the technological effort extends to the political and social arenas causing the transformation and adaptation of both animate and inanimate objects. The resultant massive, interdependent, autonomous systems are divorced from the goals of society. They exist mainly to perpetuate themselves. "Technology is now a kind of conduit, such that no matter what aims or purposes one decides to put in, a particular kind of product inevitably comes out."

WRIGHT, SUSAN. "RECOMBINANT DNA TECHNOLOGY: WHO SHALL REGULATE?" BULLETIN OF THE ATOMIC SCIENTISTS 33(8): 4-5, OCTOBER 1977.

Initial article in a planned series of differing views on the DNA regulatory legislation currently under debate in Congress. Wright points out that the NIH guidelines are considered to be flawed by "conflicts of interest and a lack of expertise for making broad policy for a rapidly emerging technology." Distinctions in the House and Senate bills are detailed. In essence, the Senate bill distributes decision-making power more widely and to commissions without professional interests in the area. A careful look at the British experience, where DNA research is already regulated by the Genetic Manipulation Advisory Group, would be instructive to U. S. legislators.

Judith Mistichelli and Christine Roysdon
Lehigh University Libraries

OPEN FORUM

In response to John Andrew's call for a list of active scholars who would be willing to visit campuses for lectures, colloquia, etc. (see HPT Newsletter #1, August 1977), the following individuals have responded. HPT News can take no responsibility other than to list those people who are willing to offer their services in this regard. All speaking arrangements must be made directly with the individual by the sponsoring institution. However, we will be glad to continue this listing service and, if you desire to have your name listed, please include your address, telephone number, and suggested titles or subjects on which you would be willing to speak. **Editor**

Avrom A. Blumberg
Professor of Chemistry and
Head, Division of Natural Sciences
and Mathematics
DePaul University
1036 West Belden Avenue
Chicago, Illinois 60614

office: 312-321-8189 home: 312-328-4807
"The ethics of scientists in national security work"
"The role of scientists in the arms race"
"Problems in arriving at arms control agreements"
"How do we know that medicines and additives are safe?"

Victor Ferkiss
Professor of Government
Georgetown University
Washington, D. C. 20057

office: 202-625-4531 or 4941
home: 301-656-9541
"Technology, Politics, and Culture"
"Technology and the Human Condition: A Futurist's View"
"Technology and the American Dream"
"Technology and Ecology"

Hall Hellman
100 High Street
Leonia, New Jersey 07605

(free lance science writer; author, Technophobia: Getting Out of the Technology Trap)
phone: 201-947-5534
"Energy in the World of the Future"
"Communications in the World of the Future"
"Technology, Society, and the Future"
"Transportation in the World of the Future"

Dennis Livingston
Dept. of History and Political Science
Rensselaer Polytechnic Institute
Troy, New York 12181
518-270-6444

flexible format: campus lectures, seminars, or class visits
"Images of the Future" - slide presentation
"Appropriate Technology and the Politics of Decentralization" - lecture/discussion
Teacher Workshops in future studies

Donald Mankin
Assoc. Professor, Studies of the Future
University of Houston at Clear Lake City
2700 Bay Area Boulevard
Houston, Texas 77058
713-488-9394

"A Futures Orientation to Industrial and Organizational Psychology"
"Suggested Contributions for the Behavioral and Social Sciences in Researching and Planning the Future"
"Future of Work, Leisure, and Education"

Alex C. Michalos, Director
Social Indicators Research Programme
University of Guelph
Guelph, Ontario, Canada
519-824-4120, x3207

social indicators
idea of a science court
obligations of engineers to clients

Paul Roman
Professor of Physics
Boston University
111 Cummington Street
Boston, Mass. 02215
Office: 617-353-2610 or 2600

Interrelations between the arts, mathematics and the natural sciences, in particular, concentrating on topics related to structure in these disciplines.

Gary D. Wooddell, Geoffrey H. Fletcher, and Thornton E. Dixon
c/o Milford Futurology Program
Milford High School
5735 Pleasant Hill Road
Milford, Ohio 45150
513-831-2990

"Future Studies in Secondary Education"
"Future Studies - Teacher Preparation"

Michael E. Zimmerman
Asst. Professor of Philosophy
Newcomb College
Tulane University
New Orleans, LA 70118

"Heidegger on Technology and Nihilism"
"Heidegger and Marx on Technology"
"The Problem of Praxis in Marcuse's Theory of Technological Culture"
"Technological Culture and the End of Philosophy"
"Dewey's Instrumentalism and the Logic of Domination"

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Dear Editor:

I would appreciate information regarding any courses on programs concerning the impact of technology on society which are being offered at the high school level.

Edward J. Gallagher
Dept. of English
Lehigh University
Bethlehem, PA 18015

Humanities Perspectives on Technology
Maginnes Hall #9
Lehigh University
Bethlehem, PA 18015

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Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

HUMANITIES PERSPECTIVES ON TECHNOLOGY

Curriculum Newsletter of the Lehigh University HPT Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 4
February 1978

This issue of the newsletter is primarily devoted to curriculum items keyed for those teaching introductory science, technology and human values courses, although there is obviously much of value for others with more specific interests. The introductory essay on Jacques Ellul is excerpted by permission of the author and publisher from a forthcoming article in Man and World, *Vol. X, no. 3, and is followed by descriptions of several introductory STS-type courses. We would, of course, like to hear from other readers regarding their experience with such ventures.* (Editor)

JACQUES ELLUL AND THE LOGIC OF TECHNOLOGY

There is little question that the works of Jacques Ellul are among the most important in what has become a vast literature on the nature of technological society and the effects of technology on the life of man. In his introduction to his translation of Ellul's main work, The Technological Society, John Wilkinson, after comparing Ellul's work first to Plato's Republic, remarks: "Even clearer is the similarity of the book to Hegel's Phänomenologie des Geistes, the last work of Western philosophy with which the present work bears comparison. The Technological Society is not a 'phenomenology of mind' but rather a 'phenomenology of the technical state of mind.'" Wilkinson's remark suggests that Ellul's work, contrary to what most of his critics have thought, is in essence a philosophical work and, what is more, a philosophical work of the first order although its scope is limited to an analysis of technological consciousness and is not an analysis of consciousness per se. Ellul's analysis of technological consciousness shows that traditional material techniques evolve to an all-pervasive mode of consciousness seeking "efficient order" in all areas of human activity. The appearance of technical civilization reveals a world where man's view of himself, of the traditional objects of the natural world, and of supreme and absolute limits is radically altered.

In recent years a substantial body of literature on the problem of technology has steadily accumulated. An examination of this literature reveals that, often, one of three approaches is taken. It is maintained that: (1) technology is inherently evil and unnatural and is something which must be done away with at all costs; (2) technology is a positive movement enabling man to free himself from the problems of the world and to take his own destiny squarely in hand; (3) technology creates problems which may be solved by refining current technologies or by applying more human goals to technological development. Ellul's view takes none of the above perspectives. His account makes it clear that the goal of technology is the traditional goal of thought--the overcoming of the bifurcation between the world and my idea of it--, and because of this, technology must be viewed as a natural direction for thought. However, if Ellul is right, man is no longer in control of his destiny and the world as he was in the past. For Ellul it is a foolish dream to search for good and moral uses of technology because technology is *use itself* and is, therefore, impervious to moral criticism and to any direction that is transcendent of it.

Ellul's critics, few as they are, miss the above points. Briefly, I will consider a few representative criticisms to show that this is the case. For Alvin Toffler, Ellul is simply pessimistic and insensitive to the endlessley varied life technology has to offer; man simply must learn to choose more rapidly. It is also argued that man is not in danger of losing his sense of free choice. Quite to the contrary, man now has more choices than ever before. Toffler does not see that, from Ellul's perspective, technology has become choice itself. For Samuel Florman, Ellul is simply wrong: agreeing in principle with Toffler that Ellul ignores the ever increasing amount of freedom gained by technology, Florman also argues that technology is not an external force in culture but that problems attributed to technology are simply a result of man's infinite capacity to desire. However, Ellul agrees that technology is not an external force, that many problems are a result of human desire, but desire in a specific form--technological desire.

Carl Mitcham and Robert Mackey, critics who take Ellul seriously as a philosopher, argue that Ellul does not clearly distinguish technique from technology, and, like Toffler and Florman, question the notion that technology is incompatible with free human choice, assuming, for example, that now modern man has more means of communication than ever before. Unlike Florman and Toffler, however, they see Ellul as maintaining that technology creates a system of internal relations such that all things acquire their reality through these relations. The question, then arises: Does man have an essence or nature over and above these relations to which he must be true? To Mitcham and Mackey it seems that Ellul, on the one hand, wishes to view man as a being whose essence is acquired through its relations--something that technology certainly effects--, while on the other hand, Ellul wants to appeal to a transcendent nature that man owes to God. While the relation of Ellul's "secular work" to his religious writings is an interesting subject, I will not pursue that question, holding that there is ample justification in *The Technological Society* for arguing that Ellul sees the question of man's nature to be importantly problematic. For Ellul, technology decides man's nature, indicating man's decision to void non-technical perspectives taken on this vital issue. Finally, for Victor Ferkiss, technology creates no problems that man cannot handle if man will remember that technology can fall into bad hands. If we are careful and use available techniques wisely and self-consciously, however, many of the problems attributed to technology would not arise. Ferkiss, however, is not aware that technology has a tendency to become consciousness itself, such that self-consciousness is no longer possible the way it is in non-technological cultures. In short, technology loses the ability to see itself against other possible ways of viewing the world.

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Jacques Ellul has written four works which expressly analyze the effects of technique on the human condition: *The Technological Society*, *Propaganda*, *The Political Illusion*, and *Autopsy of Revolution*. In analysing the logic of technique as a phenomenon in the modern world, the last three works may be viewed as enlargements of subsidiary points in *The Technological Society*, and therefore it will be my main concern. Ellul begins his discussion of technique by observing that technique is part of the natural history of all cultures because "technique" refers to any method used to attain a particular end. But, in a technical civilization, which he regards as a unique form of culture, ends become means and means become ends, thereby calling into question traditional ends-means relationships. According to Ellul, there are two senses of "technique": (1) Technique generically refers to any means used to attain an end; (2) Technique as a method of rational efficient ordering refers to a species of techniques of the technological society. It is important for Ellul's case that "technique" refers to the totality of methods rationally employed, seeking the end of absolute efficiency: in this way Ellul does not restrict "technique" to any particular technical application. As Ellul shows, technique may appear in the form of labor management in industry, in the role of urban planning in city politics, in the guise of the "scientific method" in the laboratory, and in its most obvious manifestation--the machine. In considering the latter form Ellul writes: "The machine is, solely, exclusively technique; it is pure technique, one might say. For wherever a technical factor exists, it results, almost inevitably, in mechanization: technique transforms everything it touches into a machine." Ellul contends that technique, which he regards as a unique mode of consciousness, makes the machine possible, and while the machine aids in the perpetuation of that consciousness, it is not the cause of it; rather, it represents the ultimate ideal towards which all technique strives.

For Ellul all technical phenomena have seven common characteristics: (1) rationality, (2) artificiality, (3) automatism, (4) self-augmentation, (5) monism, (6) universalism, and (7) autonomy. Rationality and artificiality are the two over-riding characteristics, while the other five are subordinate or specific manifestations of the former. Ellul describes technical rationality as consisting of two phases: "...first, the use of discourse in every operation; this excludes spontaneity, and personal creativity. Second, there is the reduction of method to its logical dimension alone. Every intervention of technique is, in effect, a reduction of facts, forces, phenomena, means, and instruments to the schema of logic." In effect Ellul is claiming that there must be a method for all activities and that that method must be capable of mathematical enumeration, reduceable, therefore, to an abstract logical schema. Techniques are always artificial because they are no longer spontaneous and because the natural world and man's relation to it becomes radically transformed as a result of technical intervention. To the technical mind, the world appears as the creation of a technique, or as a problem to be solved by technique: a dusty gravel road appears as a four-lane blacktop; a forest becomes a National Park; a children's ad hoc baseball game on a corner lot is a Little League Organization waiting to be born.

In order to see the relationship between reason and artificiality more clearly, it is necessary to examine Ellul's distinction between technical operations and technical phenomena. "Technical operation" refers to all activities carried out in accordance with a specific method for the implementation of determined ends. Characterized by method, these activities provide the continuity for all technical experiences from the rather simple task of chopping out a log canoe to the more complex programming of a computer, making us believe that primitive techniques differ only from modern techniques in degree as a result of scientific refinements, and hiding from us the fact that modern techniques are also different in kind, entailing a completely different orientation in the world. Technical operations concern the worker's immediate relation to the task at hand. This relation is always a bodily relation which requires, at least in its initial phases, the use of hands, muscles, etc., in order to accomplish this task. A technical operation may require concentrated effort while it is being learned, but soon it becomes a spontaneous and natural routine, and it is from this point that we speak of technical operations.

"Technical phenomena" appear when consciousness surveys and rationalizes what was once a spontaneous technical operation, seeking the "one best means" and the fixed end of efficiency. Considering the intervention of reason first, a problem regarded as a technical phenomenon involves a mediated technical operation such that, from the standpoint of the worker, an immediate awareness of the task at hand, be it simple or complex, is logically negated, producing a concern for more efficient means. For primitive technical operations involving tools, the worker's body provides the locus for his awareness; the tool, such as an axe or a saw, is, in this case, an extension of his body. When technical reason intervenes, however, the worker becomes aware that there must be a better way to accomplish his task, and he is led to an improvement or to a transformation of the tool. With the aid, say, of science and mathematics, a chain saw may result, an appearance of a technical phenomenon--a privative technical process objectified. Ellul seems to suggest, although he does not state it directly, that throughout the rise of technical phenomena, it is the body that must be overcome. With the chain saw, the tree is no longer the goal; rather, it is the saw itself which is my concern. I must be strong enough to support it; I must be wise enough to perpetuate its functions and understand its operation. My concern is no longer directly with the objects in the natural world but with the objects I have made as a result of my scientific and mathematical awareness.

The second aspect of technical phenomena--consciousness--appears when the one best way is sought in all fields of endeavor. Ellul states: "It is no longer the best relative means which counts, as compared to other means also in use. The choice is less and less a subjective one among several means which are potentially applicable. It is really a question of finding the best means in the absolute sense, on the basis of numerical calculation." Thus we see that man's decision to master nature has taken a definite path resulting in a union of spiritual and material techniques. Technique becomes a decision to objectify reason itself; it is now, "...a means of apprehending reality, of action on the world, which allows us to neglect all individual differences, all subjectivity...Today man lives by virtue of his participation in a truth become objective. Technique is no more than a neutral bridge between reality and the abstract man." Here Ellul discloses a crucial point in technological logic: Technique cancels individual subjectivity and individual difference by objectifying that subjectivity and by turning the object for which it is a subject into an abstraction. Individual subjectivity is embodied subjectivity. My idea of the world is never of the world as it is but is always of the world as I see it as a body located in a certain space at a specific time. My idea of the world, A, is never the same as A' in the world, a strict identity; the A' I apprehend is always an A' over there, while I am here. I apprehend A' now, not later and not in the future. For technique it is as if my body, itself an object, prevents my idea from being the world, providing as it does my most immediate environment and obstacle. With my body I am identical with other objects in the world, while being, at the same time, different. When this difference is effaced to achieve absolute objectivity with the world, abstract technical man appears. In short, technique erases the subjective factors of consciousness by which we as embodied consciousnesses relate to the world, to each other, and, most importantly, to ourselves. What is this new vision of ourselves that arises in a technological society?

With bodily processes turned into abstractions and with abstract thought processes treated as concrete realities, we find a brand new subjectivity, a unique being in the world. We have been saying that the technical mind no longer lives in a traditional world of natural objects to be manipulated bodily, but it lives among embodied conceptions which it does not distinguish from natural objects. Because of this unique and new subjectivity, technique becomes automatic, self-augmenting, monistic, universal, and autonomous. These characteristics of modern technical phenomena exemplify the structure of the technical mind with its unique logic of pursuing identities without differences--a closed logic, viciously idealistic, wherein everything is internally and necessarily related to everything else due to the technical program of reducing all activities to a rational method.

--David Lovekin
Sauk Valley College
Dixon, Illinois

A "VALUES" COURSE AT CASE WESTERN RESERVE UNIVERSITY

In 1976 the Program in the History of Science and Technology at Case Western Reserve University (Cleveland, Ohio), proposed a course in "Science, Technology, and Human Values" to be offered to students in both Case Institute of Technology (science and engineering majors) and Western Reserve College (liberal arts majors). After it was endorsed by the deans of each college, and was offered in the spring of 1977, enrollment actually did include students from both areas, as well as graduate students. As a Mellon Post-Doctoral Fellow in the Program, I taught the course.

Based on books available in paperback and my personal interests, the course had four major divisions: (1) historical and sociological introduction, (2) case studies of four areas (the professions of science and engineering; biochemistry and medical technology; ecological issues, and the modern work environment), (3) student presentations of additional case studies, and (4) fictional works confronting modern values problems. Each of these divisions was supplemented by short films and xeroxed hand-outs of current news items. Very little of the course involved lecturing; directed discussion was the normal class format.

With the perspective of a few weeks and the insights offered by written student evaluations of the course, I think it may be interesting to the readers of this newsletter to consider some personal observations on this new course. A major difficulty perceived by me, but not by the students, was the lack of a clear definition of what was meant by "values." I felt that without a definition the class could get sidetracked discussing, for example, merely political issues, rather than values issues. I suggested that values were "generalizations with identifiable components of good and evil which measure our perceptions of the world and help us to act consistently." The class did not find this definition satisfactory, but no one was able to offer an acceptable alternative. It was a surprise to me that over the remainder of the semester we were seldom hindered by the lack of an agreed verbal definition of what our discussions were to be about. Robert Piersig's notion (stated in _Zen and the Art of Motorcycle Maintenance_) that "quality" is undefinable but recognized by all, is apparently applicable to "values" as well.

This innate understanding of our subject was reflected in the ability of the students to select appropriate topics for their papers and class presentations. (Each student led a class discussion based on his or her topic.) Topics included: environmental questions about atomic power; the use of geology in urban planning; the social values in operations research; public attitudes toward technological innovation; 20th century views of science and technology as revealed in political cartoons; values in the works of artist Alexander Calder; experiments in brain control by implanted electronic devices; and military weapons' sales to Third World nations. Class evaluations revealed that the students enjoyed investigating these problem areas, and that they found other class presentations thought-provoking. I insisted on selection of a topic several weeks before the assigned date of presentation, and required each student to make a few minutes of factual presentation before leading discussion on the topic.

The choice of books for the course was generally well-received. The most popular were Lynn White's _Dynamo and Virgin Reconsidered_ and Robert Pirsig's _Zen and the Art of Motorcycle Maintenance_. _D&VR_ was the introductory work and provided the course with some historical perspective, as well as raising issues which recurred throughout the course. Another book which we read and constantly came back to was J. Bronowski's _Science and Human Values_. Pirsig's _Zen_ was our concluding text, and one which provoked the most earnest discussion. Other books included J. D. Watson's _Double Helix_; Samuel Florman's _Existential Pleasures of Engineering_ (Ch. 5); W. D. Baxter's _People or Penguins_; S. L. Udall's _Quiet Crisis_; Studs Terkel's _Working_; and Aldous Huxley's _Brave New World_.

Requests for copies of the syllabus, or questions and comments about the course may be sent to me at: Program in the History of Science and Technology, Crawford Hall, Case Western Reserve University, Cleveland, Ohio 44106.

--Darwin H. Stapleton
Case Western Reserve Univ.

HPT 11: TECHNOLOGY AND HUMAN VALUES

HPT 11 "Technology and Human Values" is the flagship course of Lehigh University's Humanities Perspectives on Technology Program. That is, this course signals the motifs that characterize all the courses in the program: generating an awareness of the impact on personal and social values of the exploitation of technological developments and exploring the interaction between science, technology and Western culture. In the Fall of 1977 an unusual opportunity presented itself in the form of a large enrollment and the availability of three instructors, experienced in teaching the course but with distinct conceptions of how it ought to be taught. We decided to offer three sections of the course and to let students choose between three approaches to the same themes. One section took a primarily literary approach, relying heavily on science fiction material to make its points (Gallagher, below). One section took a primarily historical approach and exploited visiting lecturers from various departments (Feaver). I took a primarily analytical approach, seeking to focus attention on the value alternatives embedded in different courses of action and in the personal and social consequences of acting on the basis of one or another of those alternatives. The text that held the course together, thematically, was John G. Burke's _The New Technology and Human Values_. In the course of the term we read most of the articles in this anthology, primarily as stalking horses for the value problems I wanted to raise in class (_not_ for the solutions to these problems offered by the contributors). Woven around the readings in Burke were other readings with a narrower focus.

We began the term with B. F. Skinner's _Beyond Freedom and Dignity_. I wanted the students to see a full-blown demand for an objective reconstruction of personal and social behavior, and we read this carefully. While I was critical of Skinner's claims on behalf of behavioral engineering --and forced attention on the asymmetry of improving artifacts and improving natural organisms-- I tried to make students aware of the parallel plausibility of freedom-- and of determinism-based interpretations of Man.

We followed up _Beyond Freedom and Dignity_ with _Walden Two_, in order to see what an objectively organized society might look like in practice. Here again I attempted to elaborate the value trade-offs involved in joining or not joining the Walden Two community, also to critically examine the plausibility of the community working in fact as it does in the book.

The concepts raised by these two books -- primarily objectivity, truth, science, progress, personal responsibility -- were brought to a focus by means of three plays: Friedrich Durrenmatt's _The Physicists_ and Henrik Ibsen's _Enemy of the People_ and _The Master Builder_. Durrenmatt's play allowed me to concentrate on the notion of truth: on its "saving" power, on Man's ability to cope with truth, on "progress" through truth, and on the relationship between the individual who reveals truth and the society that takes up that revelation.

The Enemy of the People served as a vehicle for focusing on the roles played by social and personal factors in establishing values and determining policy decisions. I am especially fond of making students aware of how problematic a hero Dr. Stockmann is and how benevolently the character of Mayor Stockmann may be read. In conjunction with Chapter Three of Burke's _New Technology_, I introduced a 4-point "value impact statement" to be applied to the exploitation of any technology: who will be helped by it?; who will be hurt by it?; who will be responsible for maintaining its availability?; who will be responsible for its future "legitimate" implementation?. We applied this scheme to psychiatric drug therapies, to supersonic airliners and to polygraph tests for employment interviews, with interesting results.

The Master Builder returned attention to the question of the self as the locus of action and achievement, also to the question of whether technological progress entails destruction of the past and inhibition of future innovation. In this context, we read the selections of Burke's fifth chapter and turned to Samuel Florman's The Existential Pleasures of Engineering. Florman's book has three natural divisions to it. In the first, Florman argues that not engineering but the political exploitation of engineering is responsible for the social problem "caused" by contemporary technology. In the second part, Florman considers and rebuts the anti-technology arguments of Ellul, Roszak, Reich, Dubos and Toffler. In the third part, he argues for engineering as an authentic expression of the human spirit.

Finally, we closed the course with excerpts from Joseph Weizenbaum's book Computer Power and Human Reason. I was anxious for the students to reflect on Weizenbaum's argument that the pursuit of artificial intelligence potentially jeopardizes human well being. A science fiction film festival was scheduled for the nights of the last week of classes. The idea was to revive the major themes of the course in dramatic contexts that would be constructively thought provoking vis-a-vis the imminent final examination. The films shown were Metropolis and THX 1138, The Forbin Project, Seconds and The Last Days of Man on Earth. Attendance was very good.

No course evaluation was attempted, but over 20 percent of the students spontaneously submitted comments that were quite positive.

Steven L. Goldman
Lehigh University

THE TECHNOLOGY AND HUMAN VALUES COURSE

When people ask what I teach in "Technology and Human Values" (HPT 11), I usually try to suggest an answer through reference to several icons, that is, several almost universally recognized visual images which immediately and succinctly convey the complex cultural response to technology. It is not possible to reproduce the icons here, as I can in an introductory class for instance, but, even so, I think you will find them familiar enough.

First, Frankenstein. Yes, the bolt-necked, flat headed, sloe-eyed, frozen jointed, long browed, stitched and scarred, snarling and sneering character played by Boris Karloff in the 1931 movie. This being is a giant symbol of the conflict between technology and human values. It is life made in the laboratory/factory, by a man who has placed love of knowledge over love of people. It is a successful experiment, the ultimate control over nature, and functional; yet simultaneously, to the world at large, it is ugly and dangerous, a monster. Both the movie and the 1817 Mary Shelley novel before it emphasize that man's power over his world is increasing out of all proportion to the range of his foresight, that the greatest threat to man's existence is himself. "Now I know what it feels like to be God," exults Dr. Frankenstein. Well, if we are as gods, to paraphrase the Whole Earth Catalog, we better get good at it.

Another icon - and I usually get some arguments with this one - is the familiar upper torso photo of the American astronaut, glittering like silver foil in his space suit, who has landed on the moon. I find that this picture is almost always taken as an unambiguously positive representation of the powerful flexing of our technological muscle. Man has proved himself by conquering space! But if this is a symbol of achievement, it is also a symbol of anonymity, of man made invisible by his life support systems. The visor of the space suit is empty, dark, the face invisible. We talk of space exploration as a "triumph of technology," not of individual men. That could be anybody in the suit, or nobody. A Columbia professor is recently reported to have said: "2001 illustrates perfectly that staggering things are being done by boring, bland people. Who wants to talk to one of the astronauts? This is an age of exploration that beggars Drake, but there aren't going to be any more gallant Lindberghs setting out alone; each man will be the sensitive fingers on a technological arm that stretches back through perhaps 1000 people and 15 years."

The third icon, as a matter of fact, is from the widely known Stanley Kubrick movie 2001: A Space Odyssey, the hibernaculum in which the astronauts "sleep" during the long voyage to Jupiter. The intuition in science fiction has long been that the ultimate purpose of technology is to preserve human life, which means, since man can be irrational, that machines must have control over man, that machines must save man from himself. This leads to the blurring of the distinction between the preservation of life and the quality of life preserved, between physical and psychological life. This leads to the image of man comatose in the sleek, aseptic, mummy-like, coffin shaped hibernaculum. This icon shows that the machines can best support life when man is most death-like, a vegetable, a patient etherized upon a table in a positively womb-like atmosphere. This icon complements Susan Sontag's remark that "the dark secret behind human nature used to be the upsurge of the animal," the Mr. Hyde in us all, but that now the danger to humanity lies in our availability for mechanization. "If the goal of human history is a uniform type of man, reproducing at a uniform rate, in a uniform environment, kept at a constant temperature, pressure, and humidity, living a uniformly lifeless existence, with his uniform physical needs satisfied by material goods, all inner waywardness brought into conformity by hypnotics and sedatives, or by surgical extirpation, a creature under constant mechanical pressure from incubator to incinerator," proclaims Lewis Mumford with characteristic rhetorical fervor, then "most of the problems of human development would disappear. Only one problem would remain: why should anyone, even a machine, bother to keep this kind of creature alive?"

Two icons this time, a fourth example, relate to Jacques Ellul's description of technology as man's excessive concern "to master things by means of reason, to account for what is subconscious, make quantitative what is qualitative, make clear and precise the outlines of nature, take hold of chaos and put order into it." This perception of the inordinate use of reason in the present is illustrated by several dismaying symbolic representations of our future evolution. A picture of actor David McCallum suffering graphic elephantiasis of the head, in his role as a traveller into the future in an "Outer Limits" television show, starkly displays the grotesque imbalance and distortion resulting from the elevation of head over heart. From our point in evolution we look back with condescension at Australopithecus, Zinjanthropus, Pekin man, and Neanderthal man; this icon asks us to ponder our future "shape." A picture of three diminutive intellectuals in "The Cage" episode of Star Trek also stimulates thinking about the future. These men are the masters of an advanced technology, but their bodies are as frail as a gust of wind under a sheet, their heads are doughy, their look uniformly blank. Even before the turn of the century, in his depiction of the slithery squid-like Martians in War of the Worlds as a technologically advanced human species, H. G. Wells saw the result of mechanical appliances and attitudes superseding limbs and other organs: "They were heads--merely heads. Entrails they had none." Somehow this makes us yearn like Emerson in his essay on "Self-Reliance" for the aboriginal strength of the naked New Zealander reported to have healed in two days from an ax blow to the chest.

These icons will serve to suggest the kinds of issues discussed in the "Technology and Human Values" course, but they certainly do not in any way exhaust the range of potent visual images relating to the impact of technology on our culture. Can you suggest others? Twenty years ago one might have been the Man in the Grey Flannel Suit. Norman Mailer points to the faceless quality of our modern skyscrapers. How about the stick figures of the sculptor Giacometti, the Golden Arches of McDonald's, or the Martin Tower Building? What common visual images cause you to think about the role technology plays in our lives? We'd like to hear.

Edward J. Gallagher
Dept. of English
Lehigh University

TEAM-TAUGHT COURSES: PEDAGOGICAL CHAOS?

In the October issue of HPT News Steve Goldman discussed the general philosophy of STS curricula. In the course of his highly perceptive remarks he touched on the problems of team-taught courses. Though he granted the potential value of such courses for the student, particularly if he or she could be treated to the entertaining spectacle of faculty members at each other's intellectual throats, he implied that this rarely happened. Especially singled out for disparagement were courses where "a dozen faculty troop through the classroom as 'guest lecturers'--almost always a euphemism for pedagogical chaos".

Since our own course HPT 97 (now called HPT 11, "Technology and Human Values") in fact used this very format for the first three years of our program, it might appear that these remarks are a judgment on our experience. Since Steve's encounters with courses of this kind did not, in fact, occur at Lehigh, it might set things in a slightly more balanced perspective if we described the Lehigh experience.

The course was intended for freshmen from all three Colleges. Though at first representation from the Business School was disappointing, proportions of Arts and Engineering students were very close to the proportions in the student body. Registration started around fifty for the first year and has climbed ever since. The subject matter was broad and sweeping; in fact, it was aimed at "sensitizing" the students to the issues more than informing them, although Steve would be right in feeling that we did not fully realize this at first. The purpose was to demonstrate the different perspectives provided by the whole gamut of Humanistic Disciplines on the issues raised by Technology in relation to Human Values. So Technology was seen through the lens of literature, philosophy, history, art, music, classics, and religion and the social sciences. Then representatives of the sciences and engineering disciplines were given their opportunity to comment. It was the nature of the course, not some abstract urge to "try an inter-disciplinary approach", that dictated the format.

For the first two years the class was taught by a permanent team of four faculty, (reduced in the third year to three)--one each from History, Economics, Chemical Engineering and Classics. This permanent team attended all the lectures and led discussion sections as well. I doubt that we measured up to Steve's high standards of cut and thrust in our debates with each other and with the visiting lecturers, but even so not many points went by unchallenged. Each of the team was responsible for at least one of the regular weekly lectures (sometimes two); for the remaining occasions the lectures were given by "guest-lecturers" drawn from the gamut of disciplines in the humanities, sciences, social sciences and engineering.

As Steve so acutely observed, there are real problems with such a course. It was, at least for us, terra incognita, and as ancient cartographers knew, "there be dragons". Most alarming were the dragons of Discontinuity, Irrelevance and Superficiality; nor could they be slain with the swords of Good Will or Fine Intentions. Only careful advanced planning, and thorough briefing stood any chance of keeping a coherent theme alive in the hands of so many different people. I do not mean to imply that we were always faithful in this regard; what we did observe was that our success was in direct proportion to the care that was given to making sure that every participant knew exactly what was expected. In my opinion the problems of discontinuity were far more intractable in the area of assigned readings than they were in the lectures. The latter could, with advanced notice, be tailored to our purposes, the former had to be coped with as given.

Other considerations helped as well: first, the majority of our lecturers were already involved one way or another in our HPT program and were thus familiar with our objectives. Many had participated in one or another of our faculty workshops. Second, the format for the discussion sections proved to be highly effective. The class was divided into four recitations, each led by a member of the permanent team, meeting twice a week to discuss the lectures and the assigned readings. One session was always led by the same team member; in the other, the discussion leaders rotated through the different sections. This provided both permanence and breadth of view. These discussion sections provided ample opportunity for making connections, correcting errors, or filling in the gaps, besides providing the forum for vigorous (and occasionally, ferocious) debate.

I have taught this course recently as a solo effort as well, and so I feel that I have some basis for comparison of format. A solo course, of necessity, is skewed towards the competence, interests and prejudices of a single professor. In my opinion, for a course of this nature, the team format is superior not merely for "covering" the material, but for sensitizing the students to as wide as possible a spread of opinion. I think that my opinion is shared by the rest of the team; I know it is reflected in student evaluations.

There was also a serendipitous bonus: the involvement of so many faculty from all three Colleges of the University gave HPT a wider base of informed and sympathetic faculty. There was a pay-off for them as well-- the lectures were an effective way of advertising the wares of their own discipline. I know of more than a few who picked up bright majors this way.

Douglas Feaver
Dept. of Classics
Lehigh University

STS AT STONY BROOK

Stony Brook is the recipient of an HEW institutional grant called the Federated Learning Communities. This program is a federation of interdisciplinary interest focused upon specific themes, one of which will be "Science, Technology and Society," the planning term of which begins Spring term, 1978. Six departments will participate: Chemistry (Ted Goldfarb), Engineering (John Truxall), Sociology (Charles Perrow), History (Ruth Cowan), English (Jack Ludwig) and Philosophy (Don Ihde). Undergraduates taking the program will take the six courses, one from each department indicated and participate in an integrative seminar which will be team-taught, then finish with a thesis upon some aspect of the program theme. The faculty, in turn, will participate in a weekly faculty seminar throughout a two-year period, commencing with a planning seminar, two semesters of courses and a thesis guidance semester. It is the aim of the federated programs, not only to interdisciplinarily address a common theme, but to provide a more integrated program for undergraduates in the process.

At the doctoral level one preliminary seminar, PHI 611, "Technology as a Social Phenomenon" was run last year (1977 spring) under the guidance of Professor Don Ihde with team contributions from Ruth Cowan on household technology (History), technology and bureaucracy with Charles Perrow (Sociology), technology and society with John Truxall (Engineering) and technology and ideology with George Basalla (History, University of Delaware) and a section of human-machine relations with Don Ihde (Philosophy). A variant upon this team-taught seminar will be taught Spring term, 1978 with different themes including sections on artificial intelligence and the impact of computers upon society, but drawing upon members of the federated courses listed above.

For further information, contact Prof. Don Ihde, Chairman, Dept. of Philosophy, SUNY - Stony Brook, Stony Brook, N. Y. 11790

Professor Paul T. Hopper of Penn State University, Shenango Valley Campus, Dept. of German, Sharon, PA forwarded the following brief syllabi for recent offerings in his course "Modern Science and Human Values."

SPRING 1976

Class	Discussion Material
1	orientation
2,3	Bronowski, *Science and Human Values*
4	Duerrenmatt, *The Physicists*; also the Oppenheimer case
5	Ibsen, *The Enemy of the People*; fluoridation; pesticides, preservatives
6,7	Eiseley, *The Firmament of Time*; resistance to scientific ideas
8-10	A. Leopold, *Sand County Almanac*; quick profits vs. ecology
11,12	J. Watson, *The Double Helix*
13,14	M. Polanyi, *The Tacit Dimension*
15	Midterm
16,17	J. Rosenbaum, *Is Your Volkswagen a Sex Symbol*? advertising, propaganda
18	Capek,R.U.R., in *Of Men and Machines* (*OMM*), ed. Arthur O. Lewis Cummings, p. 260; Whittemore, p. 334 in *OMM*
19	E. M. Forster, The Machine Stops, in *OMM*; Aldiss, p. 325 in *OMM*
20	Shockley, Jensen proposals; XYY chronosome comb., etc.; esp. Lee Willerman et al., in *Science* 12/18/70 (170:1329-31)
21-24	T. Roszak, *Where the Wasteland Ends*
25-27	R. Fox, *Encounter with Anthropology* (selections)
28,29	B. F. Skinner, *Walden Two*

Possible report topics: massive Vit. C to prevent colds (Linus Pauling); Galileo and the suppression of scientific ideas; psychological testing; experiments on human beings; Hans Zinsser, etc., on epidemics and immunity; alternative lifestyles and value systems: kibbutz, commune, other cultures, etc.; IQ and creativity; civilization and neuroses; Jose Delgado and artificial stimulation of the brain; Ronald Glasser and institutional purpose of hispitals; overpopulation, malnutrition, mental retardation; the Green Revolution and increased need for fertilizers and pesticides; sickle cell anemia; genetic engineering; cloning; Chinese science (J. Needham); Velikovsky; Atlantis; immortality.

SPRING 1977

1	orientation	
2,3	Bronowski, *The Identity of Man*	(robots, computers)
4-6	E. Abbey, *Desert Solitaire*	(ecology)
7-9	J. Bleibtreu, *Parable of the Beast*	(human biology)
10	open (or, guest lecture on thermodynamics as applied to energy policy, pollution, overpopulation, etc.)	
11-12	T. Roszak, *Pontifex*	(tragicomedy about our culture)
13-15	E. Sapir, *Culture, Language, and Personality* (pp. 1-44; 79-119; 172-207)	(anthropology)
16-17	Chomsky, *Problems of Knowledge and Freedom*	(linguistics, psych.)
18	midterm	
19-21	Heinlein, *The Moon Is a Harsh Mistress*	(novel; Spaceship Earth Theme)
22-25	Pirsig, *Zen and the Art of Motorcycle Maintenance*	(rhetoric, metaphysics, epistemology)
26,27	U. LeGuin, *Lathe of Heaven*	(novel about dreams with power)
28-30	Wm. I. Thompson, *At the Edge of History*	(a possible direction for history; speculations on contemporary history)

HASTINGS CENTER RECEIVES CARNEGIE GRANT FOR TWO-YEAR STUDY OF TEACHING OF ETHICS

The Hastings Center, Institute of Society, Ethics and the Life Sciences, in Hastings-on-Hudson, New York, has been awarded a two-year grant of $197,600 by the Carnegie Corporation of New York to conduct a major study of the teaching of ethics, at both the undergraduate and professional school level. This grant followed a planning grant from the Rockefeller Brothers Fund.

The Hastings Center's Project on the Teaching of Ethics will study broad questions concerning the teaching of ethics in colleges, universities, and professional schools, as well as some special problems of teaching ethics in different educational settings.

Co-directors of the project are Daniel Callahan, Ph.D., director of The Hastings Center, and Sissela Bok, Ph.D., lecturer on medical ethics at Harvard Medical School.

Arthur Caplan, Ph.D., Associate for the Humanities, is assembling information on courses now being taught or planned. Those with such material are requested to write to him at The Hastings Center, 360 Broadway, Hastings-on-Hudson, NY 10706; and they will in turn be placed on a mailing list to receive information about the project as it progresses.

Among the broad questions raised by the recent expansion of efforts to introduce students to ethical questions are:

- What are the goals, actual and possible, in the teaching of ethics?
- What is the nature of normative ethics?
- What are the special pedagogical problems posed by the teaching of ethics, and how can these problems be met?
- What is an appropriate academic background for those teaching ethics?
- How should courses on ethics and values be evaluated?

The project will also focus on special areas such as ethics and undergraduate education, ethics and pre-professional programs, and ethics and professional education in biomedicine and allied health fields, law, public policy and administration, journalism, the social sciences, engineering, and business.

Part of the project will examine the diversity of current approaches in ethical thinking, and key issues such as truth-telling, deception, confidentiality, paternalism, and personal and social responsibility.

Over the two-year period of the grant, The Hastings Center will hold a number of meetings and conferences, prepare a variety of studies, sponsor a workshop, and try to bring together those working in disparate areas who share a common concern in ethics.

Neighborhoods/cpf

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BUGLIARELLO, GEORGE. "A TECHNOLOGICAL MAGISTRATURE." BULLETIN OF THE ATOMIC SCIENTISTS 34(1): 34-7, JANUARY 1978.

Problems having to do with values are pervasive in technology, but the question of how to make technology responsive to values is complicated by society's inability to agree upon and articulate them. In the past, engineers have planned technological change only at the tactical level, leaving values discussions to other sectors, particularly government. In order to unite the "two great forces" of government and technology, Bugliarello proposes the establishment of a "technological magistrature." The "magistrature" might be described as a humanist technocracy, its activities sanctioned not by its own membership, but by expressed societal values and needs.

COATES, JOSEPH F. "TECHNOLOGICAL CHANGE AND FUTURE GROWTH: ISSUES AND OPPORTUNITIES." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 11(1): 49-74, 1977.

The Assistant to the Director of the Office of Technology Assessment explores the factors affecting future technological developments and considers their economic, social, and policy implications. Influencing factors discussed include displacement of social effectiveness by efficiency criteria, alienation of the worker, excessive size and interrelatedness of corporate enterprises, price structure of energy, societal needs outside the market system, shift in values toward participation and away from conspicuous consumption, the replacement of physical technologies by biological and social ones, new trend of science preceding new technologies. Government responsibilities lie in four areas: management of risk and uncertainty, generation and distribution of knowledge relevant to policy planning, institutionalization of technologies, support of R & D. A provocative, extensive analysis.

FLORMAN, SAMUEL C. "ENGINEERING AND THE FEMALE MIND." HARPERS 256(1533): 57-58, 60, 62-63. FEBRUARY 1978.

A short-sighted look at Smith College students leads Florman to conclude that women are not becoming engineers because, for upper-class ladies, engineering (and technology) lacks class and power. The profession is "impotent"--engineers do not make laws, have the money, or have a voice in the media. Apparently convinced that it is predominantly members of the upper-class that receive professional training, Florman makes statements such as "until lower-class women get out of the kitchen and into the university, engineering will remain a male profession." Similar exaggerated comments mar an otherwise thought-provoking discussion.

JAMISON, ANDREW. "DEMOCRATIZING TECHNOLOGY." ENVIRONMENT 20(1): 25-8, JAN./FEB. 1978.

In a little community of Tvird, Denmark stands what is today the world's largest windmill. The idea of an innovative teachers' group, it was built over a period of two years largely by volunteers with little training. The windmill is expected to provide three to six million kilowatt-hours of electricity per year, a considerable boon to the small, oil-starved nation. Jamison remarks that such a project as the Tvird windmill "marks a way back, perhaps to the widespread tinkering and inventing and understanding of technology that has been all but lost-or reduced to relatively non-productive 'hobbies' -in most of the 'advanced' capitalist countries."

MATHES, J. C. AND K. CHEN. "EDUCATIONAL OBJECTIVES FOR SCIENCE, TECHNOLOGY AND VALUES PROGRAMS." IEEE TRANSACTIONS ON EDUCATION E21(1): 27-30, 1978.

Though diversified in content, new academic programs in science, technology and society share a social problem-solving emphasis and a futures orientation. Five categories of educational objectives, the authors suggest, are appropriate to efforts to prepare students to deal with problems posed by technological change. These are: 1) the study of cultural attitudes toward social change; the development of 2) an ability to forecast, 3) problem-solving skills and 4) analyzing and synthesizing skills; and 5) the study of values considerations.

MAZUR, ALLAN. "SCIENCE COURTS." MINERVA 15(1): 1-14, SPRING 1977.

On some recent controversial issues, such as fluoridation, supersonic transport and nuclear power plants, technical experts have taken conflicting positions. "Science courts" have been suggested as a public arena for debating these differences. The court would accommodate proponents of opposing scientific views, with a panel of judges sifting and reporting on strictly factual evidence. No decision reached could be final as it might be confounded at any time by new evidence. Nevertheless, a hearing could summarize and clarify present knowledge of an issue, with results published in a form useful to policy makers and the public at large. Potential dangers posed by a "court"-dogmatism and control over research, to name two-remain to be considered.

PAPERS FROM THE INSTITUTE ON RELIGION IN AN AGE OF SCIENCE CONFERENCE ON THE ECOSYSTEM, ENERGY, AND HUMAN VALUES. ZYGON 12(2): ENTIRE ISSUE, JUNE 1977.

With the conviction that a concept of systems, which would merge practical solutions with abstract ideas, is necessary to resolve environmental problems, the conference explores the "interdependence of physical, biological and socio-cultural value systems in a world of finite resources." Odum, an environmental scientist, considers all phenomena, including human values, to be generated by flows of energy. Thus, his examination of systems of energy interaction relates values to the ecosystem's energy transfer. (His "flow charts" are intriguing.) Sociologist Harblin discusses the role of values in the development of an energy policy that could transform American culture from a "mining company" extracting short-term gain to "gardeners" tending and nurturing the environment. Whether theological beliefs mold particular attitudes toward the environment is deliberated by Marietta.

SEGAL, HOWARD P. "YOUNG WEST: THE PSYCHE OF TECHNOLOGICAL UTOPIANISM." EXTRAPOLATION 19(1): 50-58, DECEMBER 1977.

Rabbi Soloman Schindler's novel Young West: A Sequel to Edward Bellamy's Celebrated Novel Looking Backward (1894), is typical of the multitude of technological utopian visions published between 1833 and 1933. The values and goals articulated describe the "anal character": the depicted technological society embodies "excessive cleanliness, neatness, efficiency, rigidity, and control." Erikson and Fromm contend that such traits can become embraced as the "national character." The protagonist, West, is paradoxically obsessed with messiness and dirt. His career is sewage treatment, and his discovery of a process whereby offal can be sanitized, deodorized, and transformed into fertilizer catapults him to the Presidency of the land.

SCIENCE 199(4329), FEBRUARY 10, 1978.

This brings together a number of brief review articles on promising developments in energy technology and policy. Papers assess the potential of such oil alternatives as liquid fuels from coal, photovoltaic power systems and fuel from biomass, while reminding us that changes in energy source and use have a very wide-ranging impact on the character of industry. A Third World perspective is provided by a report of results of a recent NAS workshop jointly held with the government of Tanzania comparing the costs of solar technologies with currently used means for generating electricity. For countries of "intermediate" economic and technological capacity, Canada's CANDU reactor, described in the concluding paper, may have appeal.

THOMPSON, MICHAEL. "COMPUTER ART: PICTURES COMPOSED OF BINARY ELEMENTS ON A SQUARE GRID." LEONARDO 10(4): 271-76, AUTUMN 1977.

The logical procedure by which this programmer generates black and white art works on a digital computer is described. Various arrays of 3 x 5 grids of unit squares are placed in the memory bank. The computer then continually seeks to find the most appropriate array to add to the growing contextual pattern. Thompson notes that the procedure is not yet as effective as desired; the picture can usually be improved manually.

SISCON SERIES.

The following titles are numbers in the new series Science in a Social Context, published by Butterworths and edited by Bill Williams, University of Leeds. The SISCON project is a joint program by a group of universities to introduce courses on the first degree level in science with an emphasis on social aspects. Volumes are designed for course use; they are published in paperback and run approximately 100 pages. Questions, topics for discussion, and supplemental bibliographies are included in each volume as standard format.

GREEN, KENNETH AND CLIVE MORPHET. RESEARCH AND TECHNOLOGY AS ECONOMIC ACTIVITIES. LONDON: BUTTERWORTHS, 1977.

The place of research and development activities in the economic framework of capitalist systems is examined in this concise text. An introductory chapter providing definitions of basic terms such as technique, technology, innovation, and research is followed by overviews of R & D in national and international contexts, its relationship to economic growth, and the factors affecting differences in spending between industries. The most valuable section, perhaps, is the analysis of the distinct processes of R & D in two giant European firms--General Electric Company and Philips. Attention is given to funding procedures, criteria of successful innovation, expected "pay-back periods." Questions plus suggested points for discussion follow each chapter, and a useful reading list is appended.

ISAACS, LEONARD. DARWIN TO DOUBLE HELIX: THE BIOLOGICAL THEME IN SCIENCE FICTION. LONDON: BUTTERWORTHS, 1977.

Designed as a guide for a college-level course which considers the use of evolution and genetics in science fiction, Isaacs divides the program into two parts: literary responses to Darwin's theory of evolution with attention to projections of man's evolutionary future and readings in more recent science fiction dealing with man's intervention in the processes of heredity and development--genetic manipulation. The author provides introductions to each novelist's work and basic scientific background information, an annotated reading list for each chapter, and a list of discussion points and questions for class use. Works in this syllabus include The Coming Race, The Time Machine, Last and First Men, Brave New World, The Seedling Stars, and short stories by LeGuin, Wilhelm, and Wolfe. An imagivative, and effective presentation easily adaptable to high school and university classrooms.

MANNING, DANA H. SOCIETY AND FOOD: THE THIRD WORLD. LONDON: BUTTERWORTHS, 1977.

The critical problem of world food supply is enormously complex and charged with emotion. This book attempts to unravel the confusion, while refraining from offering simple solutions. It opens with a general discussion of the human impact on the biosphere and moves on to consider the psychological and cultural significance of food, the world's most significant nutritional crises and areas of present and potential food shortages. Emphasis is on the problems of the Third World, and the closing pages summarize the debate about "hard" versus "soft" technological solutions. Though the book might have been better organized, its chief faults are the unsatisfactory integration of long quotes into the text and rather weak documentation. Nevertheless, the text is thought-provoking and the bibliography adequate.

MORPHET, CLIVE. GALILEO AND COPERNICAN ASTRONOMY: A SCIENTIFIC WORLD VIEW DEFINED. LONDON: BUTTERWORTHS, 1977.

Using as a case study Galileo's quarrel with the Church over the heliocentric theory of Copernicus, this SISCON volume considers the nature of changes in world view and the way scientific innovators interact with society. Through the concise introductory chapters, students are versed in the principles of ancient and Copernican astronomy. Galileo's ideas and observations and the arguments against heliocentrism marshalled by his opponents are presented in an unbiased and dispassionate way, aided by well-chosen passages from important period documents. The student thus is encouraged to consider both sides of the controversy. The liberally included study questions for this volume are challenging, but answerable, and lead the reader to outside, often original sources. Suggestions for tutorials and a sound bibliography complete this solid addition to the series.

PAVITT, KEITH AND MICHAEL WORBOYS. SCIENCE, TECHNOLOGY AND THE MODERN INDUSTRIAL STATE. LONDON: BUTTERWORTHS, 1977.

The involvement of science and technology in industrial development and war is examined with the aim of providing students with a better perspective from which to consider the social, economic, and political implications of research and development. While the text provides an overview of the impact of science and industry from the Industrial Revolution to contemporary society, the presentation is unfocused and sketchy. Valuable concepts are mentioned but without enough depth to stimulate thoughtful consideration. Stronger emphasis on the anatomy of the military-industrial complex, the power of technology to direct economic organization and social change, as well as the current trend in research away from military applications toward the solution of social problems might have resulted in an effective course of study. Much material on the economics of R & D, available in greater depth in the Green and Morphet volume in the series, is repeated here without careful integration. However, reading lists at ends of chapters are extensive, thoughtfully compiled, and useful.

Judith Mistichelli and Christine Roysdon
Lehigh University Libraries

OPEN FORUM

In response to John Andrew's call for a list of active scholars who will be willing to visit campuses for lectures, colloquia, etc. (see HPT Newsletter #1, August 1977), the following individuals have responded. HPT News can take no responsibility other than to list those people who are willing to offer their services in this regard. All speaking arrangements must be made directly with the individual by the sponsoring institution. However, we will be glad to continue this listing service and, if you desire to have your name listed, please include your address, telephone number, and suggested titles or subjects on which you would be willing to speak. Editor

Dr. Thomas M. Butterworth
Assoc. Prof. of Biological and
Environmental Sciences
Western Connecticut State College
Danbury, CT 06810
office: 203-797-4396 home: 203-888-4789

"Biology and Society in the Year 2000"
"When Worlds Collide: Frontiersman vs. Environmental Steward"
"Ecological Gardening, A First Step Toward Self-Sufficiency"
"The Role of Science in a Humane Culture of the Future"

Dear Mr. Cutcliffe:

Thank you for No. 2 of your Newsletter which reached me today, and which I am carefully reading.

Meanwhile I advise that I am very interested in the Open Forum for the reason that over the past few years I have been giving quite a lot of thought to trying my hand at a world-study lecture tour in order to develop further my concepts of a Scientific Party and a Scienceman, etc., which my student colleague presented to the 1976 Edinburgh Conference of the International Political Science Association in the Science and Politics Section of the conference, under the title 'World Parliament For The Age of Science.' Copies may be obtained from IPSA, c/o University of Ottawa, Ottawa, KIN6N5, Canada, attention Lietle Boucher (613) 231-5818. Professor H. T. Odum, Dept. of Environmental Engineering, University of Florida, Gainesville, Fla. and Professor Stephen Carlisle, Dept. of Political Science, Knoxville Tenn. also have all our material.

Yours sincerely,

David M. Scienceman
Ph.D. Engineering
c/o University Club
70 Phillip Street
Sydney 2000 Australia
phone (02)-271323

Roger C. Schlobin forwarded the following description:

THE YEAR'S SCHOLARSHIP IN SCIENCE FICTION AND FANTASY

Roger C. Schlobin and Marshall B. Tymn, Editors

"The Year's Scholarship in Science Fiction and Fantasy" was created to fulfill the pressing need for an annual secondary bibliography on science fiction and fantasy. This project is the chronological continuation of Thomas Clareson's *Science Fiction Criticism: An Annotated Checklist* (Kent State University Press, 1972) and Marshall Tymn's annotated list of selected sf scholarship, "A Checklist of American Critical Works on SF: 1972-1973" (*Extrapolation,* December 1975).

"YSSFF" will be published annually in the December issue of *Extrapolation.* It is divided into General, Reference & Bibliography, Teaching and Visual Aids, and Author sections; each entry contains a descriptive annotation. "YSSFF" covers all American scholarship, selected British scholarship, and important criticism from major, established fanzines. It includes books, monographs, articles, Ph.D. dissertations, published M.A. theses, reprints of major criticism that have been out-of-print for a significant period, and scholarly or instructional visual media that are informative rather than simply illustrative. It will not include columns, book reviews (see Hal Hall's *Science Fiction Book Review Index,* Gale Research, 1975), unpublished M.A. theses, and published letters.

It is fully expected that "YSSFF" will relieve the scholar, teacher, and fan of the arduous and sometimes frustrating search for scholarly materials and sources among the array of critical and reference tools that appear each year.

The editors welcome the assistance of individuals and publishers in furnishing materials for future lists. Items for inclusion should be sent to Dr. Roger C. Schlobin (802 N. Calumet, Chesterton, IN 46304) or to Dr. Marshall Tymn (1470 Cedar Bend, Ann Arbor, MI 48105).

Humanities Perspectives on Technology
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HUMANITIES PERSPECTIVES ON TECHNOLOGY

Curriculum Newsletter of the Lehigh University HPT Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 5
April 1978

This issue of *Humanities Perspectives on Technology* *contains articles on three different approaches to teaching history, literature and technology. Roger Simon's and Elizabeth Fifer's introductory piece on the city (p. 1), the growth of which is intimately related to the process of industrialization, combines the more traditional historical approach with a view through the window of literature. A second approach, as taken by Douglas Wixson (p. 3) combines the visual and technical analysis of the engineer and architect with an analysis more usually associated with the field of literature to reach an understanding of the physical structures of an age and their revelations concerning the society that build them. Inherent in this approach is the historical as evidenced by the selection of readings. In the third article, (p. 7) Robert Lieberman discusses the use of a non-traditional term paper in teaching family history as a response to the restlessness which many like Alvin Toffler have seen as a result of rapid technological and social change. Interestingly, his oral history technique makes use of two highly sophisticated pieces of technological apparatus - the tape recorder and the computer.*

Hopefully these somewhat different approaches to history, literature and technology will provide you with some new ideas for courses of your own. We would appreciate hearing from you if you have other curriculum suggestions which have worked out well for you in this area, including bibliographical and audio-visual material. (Editor)

THE INDUSTRIAL CITY AND THE URBAN NOVEL

In the spring of 1977 we taught a course entitled "The Industrial City and the Urban Novel" as a part of the HPT program at Lehigh. We approached the course in the belief that the city as a whole is a vast technological container or artifact. We contrasted the themes of technology shaping the city and yet constraining human interaction. We focused on Chicago, Boston, and Paterson, N.J., and used a variety of resources: novels, poetry, films, slides, historical monographs, and a field trip. We used each city to emphasize one or two different kinds of urban experience.

For Chicago we showed slides on the history of the physical development of the city, with an emphasis on changing manufacturing technology, mass transit, and their effects on land use, residential segregation, and housing conditions. The students read three books on Chicago: Pullman, a study of the satellite industrial town and the labor strike which occurred there in 1894; Black Chicago, an historical account of the development of the black ghetto; and Native Son, Richard Wright's powerful novel of a black youth in the Chicago ghetto and his attempt at self-realization through murder. The students also saw two feature films and two documentaries on Chicago. "T. R. Baskin" told the story of a young girl who moves to Chicago from a small town in Ohio and is overwhelmed by the physical vastness and the impersonality of the city. The second film was "Raisin in the Sun," a dramatic story of a black family's attempt to escape from the ghetto to an all-white neighborhood. The focus for Chicago, then, was on the black ghetto and on the development of a working class environment, a theme to which we returned later in the course.

In examining Boston, we emphasized social class with three readings: a social geography which discussed the physical development and distribution of activities in the metropolitan area, a 1914 social worker's report on life in working class neighborhoods, and Marquand's The Late George Apley, a sardonic treatment of the Boston Brahmins at the turn of the century.

Paterson is an industrial mill town in northern New Jersey begun in the 1790s to utilize the power of the Passaic River. It is the first city in the country started specifically as an industrial community. The students read a special number of Northeast Historical Archeology devoted to the technology of Paterson's water power system and its principal industries: locomotives and silk. The students also read William Carlos William's epic poem, Paterson. Finally, we took the class on an all-day field trip to the city. The trip focused on the remains of the original water power canal system, the falls, the mill buildings, and several residential neighborhoods in the city. The Paterson unit was the most explicitly technological segment of the course.

Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

On the whole the course was an extremely valuable and useful experience for us, and hopefully for the students. It suggested new perspectives for looking at the impact of certain technologies on certain kinds of human activity. In teaching the course again, however, we would make several changes. First, rather than focusing on the general impact of technology on the city, we would concentrate on a few specific technologies and attempt to relate them to specific kinds of neighborhoods or social groups. We would organize the course around these topics rather than particular cities. An organization focusing, for example, on the ethnic working class, the black ghetto, and the middle class commuter, could explore the constraints of the physical environment and of particular kinds of work situations--assembly line, menial service work, the corporate bureaucracy--in a more concrete manner. This would be a more meaningful approach than a focus on place and it would not be necessary to confine the literary, historical, sociological, and technological materials for each topic to the same geographic locale.

We did find from our experience that having students read interdisciplinary materials from four different but related sources helped them grasp the impact of technology and technological change on the environment and the social conditions created by technology. We found that Urban Studies majors were not familiar with literary sources, and often they appreciated the chance to become acquainted with a new "primary" vision of city life. The literature majors also felt that crossing over into the factual material gave them a better grasp of the realities of city life.

Both of our approaches as teachers were different enough, too, so that students could appreciate distinctions in teaching style, as well as in methodology of our different disciplines.

--Elizabeth Fifer and Roger Simon
Dept. of English Dept. of History
Lehigh University

See following page for Course Syllabus.

COURSE SYLLABUS

THE INDUSTRIAL CITY AND THE URBAN NOVEL

REQUIRED TEXTS:

Buder, Stanley, Pullman.
Spear, Alan. Black Chicago.
Wright, Richard. Native Son.
Conzen, M. and Lewis, G., Boston: A Geographic Portrait.
Woods, R. and Kennedy, A. Zone of Emergence.
Marquand, John. Late George Apley.
Northeast Historical Archaeology, vol. 4, nos. 1-2, Spr., 1975
Williams, William Carlos, Reader.

OPTIONAL READINGS:

Farrell, James T. Young Lonigan.
Mayer, H. and Wade, R. Chicago.
Howells, W. D. Rise of Silas Lapham.
Davis, R. H. Life in the Iron Mills.
Bellow, S. Seize the Day.
__________, Dangling Man.
Fuller, H. B. With the Procession.

TOPICS AND ASSIGNMENTS:

Session 1 - Introduction to the course and to Chicago.
Film: "T. R. Baskin."

Session 2 - Chicago communities and social unrest.
Read: Pullman, entire book.

Session 3 - Black community in Chicago.
Read: Black Chicago, entire book.

Session 4 - Films: "Tenement" and "Packingtown."

Session 5 - Read: Native Son.

Session 6 - Mid-term Exam.

Session 7 - Introduction to Boston.
Read: Boston, entire book.

Session 8 - Social class in Boston.
Read: Late George Apley.

Session 9 - Film: "Last Hurrah."

Session 10 - Social communities in Boston.
Read: A Zone of Emergence, pp. 1-42, 57-186.

Session 11 - Introduction to the Mill Town. Introduction to Paterson, N. J. Northeast Historical Archaeology. entire.

Session 12 - Poets of Paterson.
Film: "Poets in America: W. C. Williams."
Read: William Carlos Williams, Paterson
Selections to be announced.

Session 13 - Field trip to Paterson, entire day. Required.

Session 14 - Summary and discussion of field trip.
Film: "The City."

THE EDUCATED EYE AND THE HAND THAT THINKS

Wall after wall, hollow to hollow
history is this rare repose
where there yet exists the echo
of a great voice, now the muffled
discourse of a harmony sounded
still. As curve on curve rebounds
the tranquil colonnade compels
the sight to a splendid oneness
that mutes all suns in serene light.
The rounded Roman arch: look well.

--Jorge Guillén

A course I have designed and am now teaching puts people studying the humanities in the same classroom with those studying engineering and science. The course is meant to open doors among these separate departments by finding a subject of common interest. The course demonstrates what I have long believed: that an engineer does have something to tell the English major, and vice versa. My own experience confirms it. I was at one time an engineer in a large industrial firm, who became an English teacher. I have found a common meeting ground within myself for these divergent interests. The course has grown out of this experience.

When I look back upon my early education, I see now that it was in some important ways miseducation. I did not learn to use my eyes, nor seeing, to trust my senses. I did not, for instance, practice translating my thoughts into the "languages" of the different communities of man, linguistic, ideological, occupational, or cultural. Like most people, I had learned the one language of my class and country and the one language of my field of study, engineering.

In the twenty-three years since that period of technological indoctrination at M.I.T., I have struggled to educate myself. I had first to de-construct what I learned by curriculum; then I could begin to learn how to learn.

I place little blame upon M.I.T.; its role is, after all, narrow in society. Like most youth growing up in post-World War II America I was part of the human "spin-off" of the enormous scientific-technological war mobilization. One day, it was thought then, we were to live in a world of automated work, fly about in autos with detachable wings, live in aluminum homes, and find meaning in leisure-time activities. I begin with myself here only to indicate in what ways I am representative of a certain history and way of thinking.

My miseducation lay in studying a fragment of the world and taking it for the whole. When I began to look at the world I saw that the facts I had learned bore upon practices that had already been abandoned. I saw that the straight-line, analytical thinking, typical of engineering, was by itself inadequate to the tasks that needed to be done.

I saw that the discipline of solving textbook problems had left my senses uncultivated and my ability to describe what I saw and felt unperceived. I was able to "plug" the numbers drawn from others' experiments into equations for the purpose of solving a problem whose importance I had to take on faith. I was never asked to judge that importance, nor suggest other problems. I was not trained to be critical, to ask questions.

I saw that what I had been set to do in school lacked all explicit relationship to the world, philosophy, belief, spirit, self, community. The kind of engineer I was trained to be was like the skilled artisan who is without membership in a guild, without citizenry, without faith, without history, without vision.

I saw, in sum, that I had not been trained to use my eyes. Nor had I been encouraged to take the evidence gathered from my own perceptions and express it to others. I was to live in a world of things whose connection with human needs was unclear, whose purpose toward any human end was unexamined.

For the next fifteen years I cast about in search of a faith, a conviction, a way of connecting my past and my education to other people and to myself. I studied at German and French universities where I first discovered for myself the humanistic foundation of Western civilization. I travelled about on foot. I trained my eyes to look; I practiced trusting my senses and my perceptions. This is not my biography; I am one representative of a generation which grew up in a society dominated by technology.

In my work, teaching at a midwestern university, I attempt in one interdisciplinary course to educate my students in trusting their eyes and writing about what they perceive. The class is a mix of students from both the humanities and engineering/science. We look at man-made structures. We study how they were made and for what purpose. We ask ourselves to what extent the structures reveal concessions to appearance, how form is matched to function. We find the "numbers" which describe the structure technically. We do something very difficult: we try to determine the structure's symbolic meaning in the context of the age and society in which it was constructed.

In this way, essentially literary tools are used for a new purpose. I believe that there is no better way of looking at structures and interpreting them than as one would, say, study a poem. Every other way of seeing--the scientific, the technical, the sociological, the religious, the historical, the psychological, etc.--is of course indispensable to understanding. But each is a single perspective, fragmented, incomplete. The literary perspective is all these things too, but less so, and closest of any to an organic comprehension of wholeness and completeness of any way of seeing we know.

My methodology consists of studying the details as they belong to the whole, since the details, considered separately in themselves, do not bear within them their own interpretive principle. It is the whole--here the structure in a context--that gives the details their significance. This is the method of Goethe in studying the connection between art and science.

The course requires several things from the student. He(she) must learn to use his(her) eyes--with curiosity and critical ability. The student must learn to see and then articulate his perceptions in a thoughtful way. In very general terms, the course encourages the student to seek the connection between the idea (expressed in language) and the material reality (the structure) which emerged from it. Goethe wrote, "Herein consists the scientific method: that we show the concept of a single phenomenon in its connection with the rest of the world of ideas."

We begin with a study of Vitruvius' _Ten Books on Architecture_ and Frontinus' _On the Aqueducts of Rome_. The study of these ancient texts, supplemented by generous use of visual documents, provides us with a way of examining, and furnishes us criteria for describing, the structures of civilizations. What is the relationship between the structural and the aesthetic in Vitruvius' design for a city? What assumptions concerning the Roman _civitas_ underlie the book? What does the Roman method of constructing aqueducts tell us about the Roman people, their laws, their attitudes, their class system, their aspirations? The stones and the texts speak if by study we can learn to interpret them.

Next we look at Abbot Suger's _De Administratione_ and the construction of the first Gothic cathedral, St. Denis. Choisy, the 19th century French art historian, said that the Gothic is the art of building large structures out of small fragments. Here my work is made easy since the manner in which the small fragments were put together so clearly represents the aspirations of the age, the central position of the Church, the sense of community, the force of belief, and so forth. The magic mountain rising from the village of Chartres was meant for the eye; it is my task to educate the modern eyes of the students to read what it meant, not solely through its exterior appearance but also through its technical manner of construction. For this we have Suger, de Honnecourt, and numerous important commentaries. In addition, I use slides I have taken of European cathedrals and of the original designs made by their master-builders.

Of all men who ever lived, Leonardo had perhaps the best trained eye and the most thoughtful hand. Da Vinci's _Notebooks_ contain sketches of nature, and of his own creations inspired by close observation of nature's processes and forces. The art critic Berenson wrote: "the quality of qualities of Leonardo's drawings is the feeling it gives of unimpeded, untroubled, unaltered _transfer of the object in his vision to the paper_ . . . . And yet so little effort is there to be perceived in this wonderful alchemy that it is as if suddenly, by mere feat of demiurge, earth were transsubstantiated to heaven" (italics mine). In studying da Vinci's _Notebooks_ we engage in the process of learning, through da Vinci's example, how to see and how to translate what we see into words, an ability, as I have implied, generally neglected in modern university education.

Our last example of how the eye and the thinking hand work together is very close to home: the Eads' Bridge in St. Louis, built in 1868-74 by Captain James B. Eads who, with no formal engineering training, grasped the principle of the ribbed arch and explained it to skeptics in a manner that few trained bridge builders and students of engineering today can match. The Ead's Bridge, still carrying traffic, is not only structurally a masterpiece of design, but very pleasing to the eye. In an intriguing essay Professor David Billington of Princeton University has argued that what is pleasing to the eye is also, in some cases, good engineering design. We have come back to the Greeks, when form perfectly matched function. The Ead's Bridge represents our own age's concept of function, namely utility. It embodies utility in a noble way, we might argue. And it is, of course, a symbol of man's aspiration to move westward.

We arrive at the student's own contribution. During the course he has studied selected texts of the past and observed carefully by means of slides and photographs the structures corresponding to them. He is now ready to choose his own structure and write his own text.

Some examples of structures chosen by students are the Kansas City Union Station, a German church in Westphalia, Missouri, an Ozark low-water bridge, Lambert Field airport terminal, Shaws' Garden Climatron--generally structures with which they are familiar. By studying the past, the student has practiced objectifying his view of familiar structures.

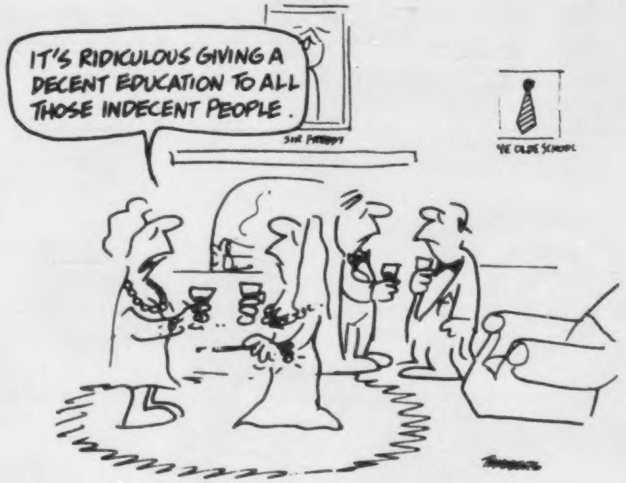
The camera is a great aid in training the eye to see. If the student does not have a camera, I lend him mine. On weekends and during longer breaks the student stalks a structure of potential interest. The structure need have no architectural significance. A car-wash barn is unquestionably a symbol of our age, or a gas station of the old-fashioned kind where once pennants fluttered and men in starched uniforms sprinted out to wash your windshield, or a queer looking water-tower. Structures tell us of a time, a place, a society's aspirations and attitudes - how it chooses to spend its money, dispense its talent, and organize its environment. The student is encouraged to consider the "human value" implications of any given structure--how it both represents and affects how people in society live and think.

The project takes the student beyond the classroom; the environment becomes a "library" of structures. He learns to look through "the facades of modernity (airplanes, elevator, computers, network television, et cetera) for the architecture of civilization," as Lewis Lapham terms it in the February 1978 issue of Harper's.

In their final presentation the students "bring" the structure to the classroom by means of slides and drawings. They make a formal oral presentation based on their own written document of the structure, eliciting critical response from their classmates.

The student's project places him at the center of the course. Is this not the purpose of education? Not to clobber him with facts and crushing examples of others' achievements, but to excite the student's own imagination and latent abilities to create something, no matter how inconsequential, for his own age. The methodology of the course then is intended to enable the student to work on his own, to trust what he sees, and to know how to communicate what he sees to others. Student evaluations and informal comments have been very positive.

--Douglas Wixson
Dept. of Humanities
Univ. of Missouri-Rolla


IT'S RIDICULOUS GIVING A DECENT EDUCATION TO ALL THOSE INDECENT PEOPLE.
YE OLDE SCHOOL

Tandberg-ANS/cpf

FAMILY HISTORY: LEARNING ABOUT YOUR PAST

Purpose

As an Historian, part of my job is to help students fight the feeling of being strangers in a strange world. Through class discussions and outside assignments, my students investigate themselves and their own family history. For the urban, open admissions, community college student, the more traditional history topics such as "Andrew Jackson and the Bank War" or "Manifest Destiny" are inappropriate and practically useless in teaching them about themselves and their culture. Inappropriate not only because they are not interested in their topic, but also because these students are part of a society that is concerned with the immediate and the particular, not the past and the more general themes.

More specifically, most of my students think of the past as last week and feel little relevance for any investigation beyond that point. But, it is really no surprise given the world they live in. It is a confusing world of rapid change, monumental problems, and solutions that they do not control. Their clock-radios awaken them to the message that the air is unacceptable today. What are they to do? Moreover, the experiences they are having at college alienate them from their home life. Typically they are the first generation to attend college. This education is, on the one hand, very liberating but, on the other, very isolating, isolating from the rest of the family that views higher education as important but possibly dangerous. The mass media does not help this process. In fact, it probably supports the isolation. For many of my students the T.V. is given a prominent place at the dinner table, the only member of the dinner that makes any noise. All members of the family sit with their eyes and ears attentive to the technological guest. The family story, either of the day's activities or of past events, is rarely passed on to the children. My students are becoming a generation hungry for their heritage. This is why I developed a term paper assignment that requires the student to talk to their family and investigate the family history.

Through a tightly structured assignment, the family history project has as its goals not only to teach the student the methods of historical inquiry, but also to combat some of the alienation they feel regarding their own history. The student is required to interview his or her parents, grandparents and the oldest living relatives. They create an oral history data bank as part of the project. In an interesting twist, the computer is used in this project to compare each individual's family pattern to the aggregated family patterns of the class. The answers to the interview questions are recorded on machine readable answer sheets. The answers for each question are aggregated so that the student can compare his family to the class as a whole. The computer becomes a machine that combats a feeling of isolation. Students start to realize that their family story is quite similar to that of other people in the class.

This project also requires that they write to public and private agencies to collect written documents on the family. The student's family is thus drawn out of the anonymity of the public record. In addition, students read scholarly works on their own ethnic, race, religious and social class group. In reading these scholarly works they are instructed to look for the effects of racism, class structure, wars and government policy on their group. In the final analysis, they discover much more than how and why their family life style changed over time; they discover the persistent threads of the family's history.

The family history term paper also has its rewards for the instructor. First, through this project the instructor will learn more about the students. Through reading about their family stories one learns about the experiences of other cultures that they are expected to teach. Second, scholars interested in social history can look forward to reading term papers as interesting data sources. The term papers are usually about immigration and the experiences of uprooted people, people that travel from farm life in one part of the world to factory life in another. These students and their ancestors are a part of a story that has been lost in the historic record. Unlike the Adams family, they did not keep diaries or letter books. Their story is in the oral remembrances and written records found in various public and private agency archives. Third, it is a challenge to teach an innovative term paper. The more traditional term paper that so many undergraduates write is a bore to teach and to read. Instructors learn very little from student research into the more traditional topics. It is a learning experience and a challenge to develop and teach a method that will produce a ten-page, documented, family history.

Method

The key to the method is to divide the project into ten clearly-defined steps due at the end of each week of a ten-week quarter. The first step is to go over the entire assignment with the class during the first week of class. Students who are expecting the more traditional topics have to be convinced of the academic worth of this assignment. Many students, less so now that Roots has appeared, have claimed that "this is not real history." Thus, it is crucial to clearly state that the purpose of this term paper assignment is: (1) to learn more about your family and yourself; (2) to learn some of the methods, concepts and skills of history and (3) to realize that the research process is not just difficult, but also fun.

During this first week, students are asked to fill out a family pedigree (tree) chart. The pedigree chart includes: names, birth year, marriage year and death year. Important data appears in the family pedigree. One fifty-year old black student was able to trace his family back to his great-grandfather, Benjamin Franklin Smith, a minister/farmer born in Vanceboro, North Carolina on July 25, 1828. Another student discovered that her eight great-grandparents came from four different countries--Ecuador, France, England and Ireland. For these students, the project is quite exciting and rewarding. During the second week, students are required to start: (1) to write for documents on the family and (2) to interview family members (including themselves). In addition, each student must start reading a book that relates to their family history. This book can be a history of their country or a history of their ethnic group.

The family interviews create a data base for the students. They are to start the second week of the course by interviewing themselves and handing in the answers at the end of the week (see attached). During the third week, the students interview their parents. They ask their parents the same questions they asked themselves. It was through the interviews that one student discovered an ancestor who had been an officer with the Russian Czar's army during the War of 1812. Another student found out that her grandfather, born in 1874, was a wealthy sugar cane plantation owner in Cuba. Unfortunately, the family fortune was lost in the 1930s due to the world wide depression and an over supply of sugar cane.

In addition to answering the prescribed questions, the students also fill out a machine readable answer sheet to the questions for each generation. The sixty-nine questions are grouped into three categories: (1) Family Life Style, (2) Geographic Mobility and (3) Social Mobility. All students are required to write on

Family Life Style and one of the other two topics. The questions are grouped so that the students will start to think of the interview as a data base for a term paper theme. Students who select Social Mobility are reminded to measure social status by occupation, wage and education. The focus on Social Mobility typically starts with a great-grandfather who perhaps sold goat or cow milk and raised vegetables in late nineteenth century Naples. His son, a rebellious 21 year old, decides to leave because "it was hard for a man to make a decent living" on the land. He leaves for New York and takes a job at the L. & G. Metal Factory in Ozone Park, Queens. After a series of jobs, he becomes a foremen at the Brooklyn Union Gas Company. His son, my student's father, also works for the gas company and is now a manager about to retire.

At the end of the fourth week of the course, copies of the letters they have written to public and private agencies are due. For written material on the family, students are required to contact: churches, courthouses, public health departments, military offices, the Immigration and Naturalization Service, census bureaus and the National Archives. It is very difficult, but very rewarding, to find birth certificates, marriage certificates, death certificates, pension records or the Naturalization records of one's ancestors. A death certificate in 1898 New York asked occupation, birthplace, length of residence in the United States, father's name, father's birthplace, mother's name, mother's birthplace and class of the last place of residence. If students know the name and address of their relatives, they can usually locate them in the Federal Census of 1880 or the New York State Census of 1905, 1915 or 1925. A major problem arises with the newly arrived immigrant. Some students have worked with their nation's embassy in Washington or the U. S. Consulate in their native country. However, for most students, finding the written record is very time-consuming and full of the dead ends that all researchers face. The effort is a learning experience.

The fifth week of the course the interviews of the grand-parents are due. During the sixth week the students interview their oldest relative. With each interview a machine readable answer sheet for that generation is also handed in. At this point the aggregated class profile from the computer is handed out. Students learn not only how to interpret SPSS print out, but also how to compare their family to the class as an aggregate.

The following two tables are typical of the data we analyze.

TABLE I

Who Moved First In Your Family (N=71)

Men	59%
Women	41%

TABLE II

How Were Family Members Ranked In Terms Of Their Privileges And Obligations (N=71)

Sex	15%
Age	57%
Ability	20%
Success	8%

At the end of the seventh week note cards on the books the students are reading and also census tract data on the family in 1880, 1905, 1915, and 1925 are due. During the eighth week the students hand in a list of events that have affected each generation. This list becomes the basis of a class discussion. At this point, the instructor must reveal to them the art of analysis. This is a very complicated step. Students have a difficult time reading interview notes, death certificates and pension records and turning them into paragraphs on Life Style, Social or Geographic Mobility. Analysis of data and explanations of change over time are intellectual processes which must be taught. On the last day of the course, a final ten-page typed paper with all the data as an appendix is handed in.* The students are reminded that the final grade is a cumulative grade that takes into consideration how well they did the process, all ten steps.

Conclusion

In doing a family history, students learn in a very personal way how to analyze historical data. They learn the connection between historical forces and the changes in their family life patterns over the generations. For the first time many students become curious about their own past. Government agencies, computer technology and relatives become personal resources rather than alienating forces. One also notices a change in attitude toward historical research. At the end of this project most students comment that the data gathering was difficult but fascinating. They talked to their parents or grandparents for the first time about the family. Some students comment that the usual routine of television watching was interrupted by the "family history project." The adult students see the final paper as something they will hand down to their children. Many students on their summer vacation trips will write a postcard about how they are continuing the family history project now that they are meeting a relative who has some family data. Others note that they are meeting other people that have interesting family histories. For all students this can be one of their more meaningful undergraduate experiences.

--Richard K. Lieberman
Dept. of Social Science
LaGuardia Community College

INTERVIEW QUESTIONS
(for each generation)

A. Family Life Style:
(1) Birth date, Marriage date, Death date.
(2) Maiden name, married names.
(3) Discuss sex roles according to your occupation, income, mobility, and religious beliefs.
(4) Who ruled your family?
(5) How many members in your family?
(6) Were any members of your family famous?
(7) What member of your family brought about the most change for the entire family tree?
(8) Did family members other than the parents and their children live in the same apartment or house, in the same building, along the same street or in the same neighborhood?
(9) Did married daughters or sons continue to live in their parents' household?
(10) Did aging parents live in their children's households, in their own dwellings, in retirement communities, or in old age homes?
(11) How did the family organize its living space? Who slept in what room? How was the work and living space divided? How crowded was the household?
(12) Were there servants or boarders living with the family?
(13) Who cared for sick or dependent family members?
(14) Who visited whom, how frequently and over what periods of time?
(15) How were key decisions made on moving, schooling, occupational choice, and approval of marriage?
(16) How were decisions on daily family business made? (Budget, housekeeping, etc.)
(17) Who disciplined the children and by what means?
(18) Aside from parents, what other adults participated in disciplining the children? Did grandparents participate in rearing their grandchildren?
(19) What types of conflict occurred in the family and what were the responses?
(20) How did your parents meet? Who arranged the marriage?
(21) How were family members ranked (sex, age, ability, occupation, success) in terms of their privileges and obligations?
(22) What were the sitting arrangements during meals?
(23) How were babies treated in the family?
(24) Up to what age was a child considered a "child"?
(25) Was "adolescence" considered a special stage?
(26) At what age was a young person expected to take on adult responsibilities?
(27) What were attitudes towards aging?
(28) Did aging parents continue to live with their children?
(29) Has the family become less religious over the past three or four generations? How many times a month do you attend church?
(30) Trace the membership in community groups and social clubs over the three or four generations.
(31) What were the daily schedules of family members? How did they spend their time at home and their holidays?
(32) What kind of family celebrations were held? Were there family reunions held? Who attended? Where were they held?

B. Geographic Mobility

(33) If you can get the County, and State for any of your ancestors in 1880, 1890, 1905, 1915, or 1925, speak to me immediately.
(34) Geographic mobility should be traced in terms of number of times moved and the distance for each move. A map is quite helpful.
(35) How many times have you moved? How far?
(36) Why did you leave each place?
(37) What attracted you to the new neighborhood?
(38) What member of the family migrated to the new neighborhood first?
(39) You can get demographic data on your present neighborhood from the Queens Community Planning, office of Neighborhood Services, 29-27 41st Ave., L.I.C., N. Y.

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* Students sign a release form so that the data can be stored and used in a Family History Archive.

(40) If your family has been in the neighborhood for over 25 years, see me immediately.
(41) Give the addresses of every place you lived.
(42) Who in the family was first to emigrate to the United States or to move from one location to another?
(43) What relatives followed?
(44) Why did family members decide to migrate and relocate?
(45) What contact continued with the old country?
(46) How often did family members return to areas they had moved from?
(47) Did they remember their places of origin with nostalgia?
(48) Did you move for a better job, better school system for the children, to be closer to family and friends, or for better transportation lines?
(49) What year did you immigrate to this country? See me with this data.
(50) Who did you know in the new country or neighborhood?

C. Social Mobility

(51) List every job you ever had, the dates and the salary.
(52) What was the highest grade of schooling you have had?
(53) What is your attitude toward work?
(54) Who helped you get each job?
(55) What skills did you need for each job?
(56) Did you find discrimination in getting a job or on the job?
(57) Did the military prepare you for a job?
(58) Who came from a higher status family, your mother or father?
(59) How did well-to-do members of the family relate to those of lesser means?
(60) Did parents help their children in college or business? Did mature sons and daughters support their aging parents?
(61) Did the women receive dowries?
(62) Who inherited what?
(63) At what age did sons and daughters leave home to embark on their careers? Did women leave earlier than men?
(64) Did sons follow their fathers' occupations?
(65) What was the family's attitude towards the work of women?
(66) What influence did parents and grandparents have on the occupational choices of their grandchildren?
(67) What criteria and priorities did family members set for "success"? (Financial, occupational, residential, scholarly, "good marriages".)
(68) What do you do for fun?
(69) Has T.V. affected the family in any way?

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* * * * * *

David P. Billington, Professor of Civil Engineering, Princeton University, Princeton, N.J. 08540, forwarded the following copies of the Preface, Notes, and Table of Contents from a book of class notes for his course, CE 262, Structures and The Urban Environment, thinking they might be of interest to other readers. Copies of the book are available from the Princeton University Store for $7.80.

PREFACE

This course seeks to develop a basic understanding of the scientific rationale behind the structural form for large-scale urban public works, of the urban social context within which such works are funded and built, and of the symbolic meaning of these structures seen as cultural monuments and works of art.

These lecture notes that are the substance of this volume discuss the political issues raised by large public works structures because of their great cost and of the changes they bring to the fabric of the city. They develop these issues by comparative critical analyses of, for example, such individual works as the Washington Monument and the Eiffel Tower, such building complexes as Chicago's John Hancock Center and New York's World Trade Center, and such regional structuring as the port complex of Greater Rotterdam and that of Greater New York. Here the engineering student can find through specific examples, how the works of engineers and in some cases the actions of engineers have played a central role in modern society while at the same time the liberal arts student has the experience of seeing the central issues of urban life from the perspective of the engineer. By studying these selected structures students can see how public works designed by the visually sensitive engineer provide not only needed public facilities at minimum public cost but also essential visual elegance with maximum access. Technological parks, such as the Brooklyn Bridge's central elevated walkway or Rotterdam's Berenplaat water treatment plant, show how public structures essential to urban life can become, at the same time, elegant environments for relaxation and for recreation.

Following the lecture notes are a series of structural studies which present the elements of structural form using equilibrium equations to compute internal forces arising from external loads. By emphasizing overall behavior, these studies develop by simple computations the rationale for such forms as, for example, the Eiffel Tower, the Brooklyn Bridge, and the Chicago John Hancock Center. Such computations provide the engineering student with an insight into form not normally available in technical courses and give the liberal arts student an introduction into engineering concepts by learning some of the simplest techniques used by practicing engineers.

The course includes illustrated lectures which go together with these notes as well as classes. During the first half of the course the classes focus on the structural studies while during the second half they center on the term paper, the criteria for which appears at the end of this volume.

NOTES

All photographs are by the author unless noted otherwise in parantheses under the figure. All diagrams were made under the direction of Tony Poli.

The contents of Lecture 7, slightly revised, is taken from "History and Esthetics in Suspension Bridges", by David P. Billington, Journal of the Structural Division, ASCE, ST8, August 1977, pp 1655-1672.

The contents of Lecture 11, slightly revised, is taken from "Historical Perspective on Prestressed Concrete", by David P. Billington, Journal Prestressed Concrete Institute, v. 21, no. 5, September-October 1976, pp 48-71.

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HANDLE WITH CARE

AN AUDIO-VISUAL REVIEW

Inventions and Technology That Shaped America (1971).

Learning Corporation of America,
1350 Avenue of the Americas,
New York, New York 10019

Contains 18 filmstrips, 18 cassettes and instructor's guides. Total time approx. 3 hours and 20 minutes. Cost $225.

This set is unsophisticated to say the least.

Based upon the findings of other reviewers of audio-visual materials in this newsletter, I had mixed feelings about what to expect in sitting down to view and review this cassette/filmstrip set. After alternate feelings of frustration over weak historical generalizations and pleasure at a well-handled and illustrated point of concern, I ultimately came away with the same mixed feelings with which I sat down. I do not believe they are a result of preconceptions; however, to avoid any such possibilities I would like to expand beyond a mere review of this program and set out some general ideas on the use and abuse of audio-visual materials.

The market for Inventions and Technology that Shaped America is quite evident from the contents - high school and perhaps introductory community and four-year college courses, perhaps. This approach seems to be dictated by the general concerns of a capitalistic market economy which seeks the widest potential spread of interest. I have no quarrel with the intended market, only with the way in which some of the material is handled, for reasons I will expand upon shortly. Students need and deserve better education. This is true, not only when they are paying tuition, but also in the public schools. It is no longer enough to complain about the poor quality of high school students coming to the colleges, passing the buck off to the high school teacher, for where initially are these teachers getting their training?

As most educators know, the teaching of young and developing minds is fraught with pitfalls. However, sometimes we tend to forget this simple understanding. A case in point is an unimaginative thoughtless use of audio-visual materials. In this reviewer's opinion, the use of audio-visuals should be a supplement not a replacement for traditional print and lecture material. What I fear, and here we come to the specifics of this particular set, is the unexamined acceptance of the content of audio-visual material. In many ways audio-visuals are the most demanding of educational techniques to use properly.

Admittedly in an introduction to the history of American technology and its impact on society - and this is all that the set purports to be - one can only touch upon the highlights, and no one expects a graduate-level analysis of sources and differing interpretations. However, this makes it doubly important that the overview not be misleading - intentionally or otherwise. I base this statement on the one most frequent observation I have made in teaching introductory American survey courses on the college level. By and large, most students coming out of high school expect a single "true" answer or explanation for an event or series of events. While there are usually specific dates, places, and people involved, there is seldom a single answer that is not open to some discussion or difference of opinion. With this in mind, I would like to make some observations on the specifics of Inventions and Technology that Shaped America.

The set is divided into three parts of

six filmstrips and cassettes each, Set I: Colonial Times to Civil War; Set II: Civil War to World War I; Set III; WW I to Tomorrow. Given the physical limitations of celluloid and tape, some sort of division is necessary. My quibble comes with the nature of the divisions, in this case, based on dates. Historians have long divided their discipline according to periods - the Revolution, the Age of Jackson, the Progressive Era. However, these are political periodizations and to me seem unsuitable for technological trends. To end the first set with the Civil War when it specifically covers the process of industrialization including some 20th century technologies is potently misleading. I fear for the student exposed to this without additional explication. The material itself speaks directly to this point.

After an introductory filmstrip, "The Second American Revolution: Technology" (14:15) which includes European antecedents, colonial technology, the "American System," mass production, and the problems of pollution and urban decay, among others, the set moves on to more specific topics. The second strip - although it inexplicably comes first in the brief accompanying instructors guide - concerns "The Communications Breakthrough: Telegraph and Telephone" (12:15). That technology cannot be precisely periodized is no where more evident than in this strip, over half of which deals with Edison's teleprinter and stockticker, the transatlantic cable, and Bell's telephone and its subsequent uses - events clearly outside the set's end date, the Civil War. Strip 3, "Man Makes His Climate: Refrigeration" (14:00) succumbs to the same problem; not only does it include information on the colonial ice trade and the early mechanization of ice production, but also material on Pullman railroad car airconditioning, Birdseye frozen foods, and the effect of the home refrigerator on today's housewife. My question is not whether the material is important, for it certainly is, but rather why go through the illusion of setting the Civil War as an end date for the set, when the material included patently transcends the chonology? Two quite accurate overviews Strips 4, "The Steam Engine: From Riverboat to Iron Horse" (8:45) and 5, "The Agricultural Revolution: Plow and Reaper" (9:55) are less prone to this dating problem but still end with diesels and the gasoline tractor respectively - certainly plausible endings - but enough said about dates.

A more important criticism needs to be made concerning Strip 6, "Eli Whitney Changes America: The Cotton Gin and Interchangeable Parts" (8:30), but first a point of clarification. I am not an expert in all the many phases of the history of American technology, indeed, most people are not; this, however, makes the following all the more crucial. Contrary to the thought contained in recent scholarship, Eli Whitney is made out as the "inventor" of interchangeable parts. In point of fact, others had earlier conceived of the idea, and Whitney himself actually failed to fulfill his first government arms contract on time.

Because the set was produced in 1971, I clearly do not expect the producers or advisor to have been aware of works such as Merritt Roe Smith's recent Harper's Ferry Armory and the New Technology,The Challenge of Change (Ithaca, 1976). I do believe, however, Robert S. Woodbury's important article, "The Legend of Eli Whitney and Interchangeable Parts" Technology and Culture (1960): 235-254 cast enough of a shadow on the myth, that this oversimplication should not have been made. The reason for my concern? In Woodbury's words,

> Why not let this nice convenient legend go on? Were it Whitney alone that concerns us, that might be well enough. But the issue is larger than that. The history of our industrial growth is of first importance to the understanding of our American heritage. That industrial development cannot be properly understood without careful consideration of its technological

> basis. Therefore the true story of the 'Birth of American Technology' is of prime concern to us. We should make certain that baby is perfect and legitimate.

Another point in contention here is the continued emphasis on the "heroic" inventor. Although the 18th and 19th centuries did not have the facilities of today's corporate R & D sectors or government "Think Tanks," invention seldom emerged full-blown in the mind of any single inventor. Rather, people like Whitney and later Edison were very dependent upon the work of predecessors, associates, and subordinates. Invention is a process, not a happening. This is why I suggest the set lacks sophistication and reinforces the single - cause answer syndrome of high school students noted above. Again, the material emphasizes this fact by its inability to fit the preordained time periods of the program's producers.

As a note in passing, I would highly recommend that those interested in this subject area read both Smith and Woodbury.

Not wishing to belabor my point further, I will only briefly summarize the contents of Sets II and III of the program. Others will perhaps find particular points of fact or emphasis with which to quibble, I would only say that I find the same problems of dating and sophistication throughout.

After a general strip entitled, "Abundant America: The Use and Misuse of Natural Resources" (9:30) which discusses the facts of and attitudes toward resource exploitation, Set II moves on to consider specific "technologies." Strip 2, covers, "Steel: A Process, an Empire, a Lifestyle" (9:45) emphasizing the importance of steel to the American economy. "Oil: From Underground Well to Corporate Trust," (11:00), is the title of Strip 3, which outlines the development of oil, from Titusville in 1859 to the coming of the automobile, emphasizing the role of J. D. Rockefeller and Standard Oil. The origins of the automobile, Henry Ford's assembly line production of the Model T for the "masses," and the resultant expansion of suburbia are treated in Strip 4, "The Automobile: Henry Ford Reshapes America," (9:10). Obviously one cannot include everything, but here, especially if we ignore the end date, I feel constrained to point out the failure to consider Alfred Sloan's contributions to automobile production and industry organization as well as an overemphasis on the automobile as the early shaper of suburbia. For example, consider the impact of public transportation on neighborhood development analyzed in Sam Bass Warner, Streetcar Suburbs: The Process of Growth in Boston 1870-1900 (New York, 1969), the latter certainly within the time period of the set, the Civil War to World War I. Strips 5 and 6 cover "Photography: Man Extends His Vision" (11:45) and "The American Art of Persuasion: Linotype, Rotary Press and Advertising" (11:35) respectively. Both of these summaries seem quite adequate, the latter raising some especially interesting questions regarding ethics and advertising's impact on values.

Of the three sets, the third, which covers the time period from World War I to the present is the most successful in my opinion. Perhaps this is because it is the least historical. By this I mean the modern period lends itself to more open-ended, perhaps unanswerable, questions regarding the impact of technology. Strip I, "Efficient America: The Importance of 'Know-How'" (11:20) is a survey of innovation, mechanization, and the desire for efficiency. Although we are again treated to Eli Whitney as the inventor of interchangeable parts, the strip has some interesting material on Frederick Taylor and scientific management. A second strip, "Synthetics: Engineering the Molecule" (11:30) covers the development of plastics from its scientific basis in molecular theory to their impact on war and medicine. Transportation and communication in the form of air travel is the topic of Strip

3, "Flight: Overcoming Distance" (11:30). "Radio and Television: The Power of the Air Waves" (12:40) picks up where the sections on photography and film and printing and advertising left off in Set II. One might wish that these three strips had been better coordinated and related. Perhaps the concern with traditional periodization again got in the way of thematic development. "The Computer" headlines the 5th strip, subtitled, "Man Extends His Brain" (11:40). Making extensive use of specially done hand drawings, rather than photographs, this strip creates a make-believe scenario of the Universal Widgit Company, which raises the standard questions of the computer's impact: time savings and increased efficiency at the expense of jobs and the human touch, ending on the theme of man/machine interdependence.

"The final strip, "Where Will Technology Take Us?" (11:40) provides a brief historical recap of the highlights of previous strips and then offers some general considerations regarding the impact of technology upon today's and tomorrow's society - ironically, as Americans try to solve the problems created by technology, other countries are looking to technology for the answers to their problems. "Can we anticipate the problems of the future, and if we can anticipate them, can we prevent them?"

Turning again from the specific to the general, I would conclude with several comments relative to technical aspects of the program. Each of the three sets comes housed in its own box containing the six filmstrips and accompanying cassette tapes. The cassettes have a signal which automatically advances the filmstrip projector, if so equipped, or indicating the proper moment for manual advance. A small booklet accompanies each set; however, a one paragraph summary of each strip's content is all that is included. One gets neither a script of the tape nor a list of sources for the illustrative material, both of which would be helpful to the instructor. In addition, there are included several questions and extension activities for use after viewing. The questions are mixed in scope and seem to follow no pattern. Some ask for mere factual regurgitation, while others ask quite provocative and far reaching questions regarding technology's impact.

In terms of the illustrative and audio material, I have some problems. The producers have made use of a variety of early prints, photographs, and drawings made to illustrate a particular point for which there was apparently no other readily available material. This is standard practice in such pre-packaged sets and the quality of reproduction is quite good, but the repetition of slides from one set to another and even within sets is appalling. One photograph of a modern highway cloverleaf appears so often as to be hypnotic. In addition, the use of stereotyped accents, in the reading of accompanying quotes, particularly from the south or supposed frontier, is "tacky" to say the least.

These final comments only serve to highlight my original point of concern. While there is much good material here, it must be used very carefully, and the packaged nature of the sets are not conducive to this. One should have a broad range of background to avoid oversimplication and misconception; by itself the material will not stand alone. Handle with care!

--Stephen H. Cutcliffe
HPT Program

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BOORSTIN, DANIEL J. "POLITICAL TECHNOLOGY: REFLECTIONS ON THE CONTINUING AMERICAN EXPERIMENT." HARPER'S 256 (1534): 43-50, MARCH 1978.

"Experimentalism," in the forms of political federalism and technological development, is the spirit of American civilization. This diffuse essay discusses similarities between our technology, political documents and structures, and educational system. Crucial distinctions include the reversibility and displaciveness of political revolutions as compared to the irreversibility of technological innovations and their tendency to create new roles for displaced devices. Generally, however, most aspects of our culture reflect concern for everyday consequences and for satisfying specific needs, an openness to the future, and a dissolution of boundaries between traditional disciplines. Gleaned from his forthcoming book, The Republic of Technology: Reflections on Our Future Community (July, Harper and Row).

CARPENTER, STANLEY R. "DEVELOPMENTS IN THE PHILOSOPHY OF TECHNOLOGY IN AMERICA." TECHNOLOGY AND CULTURE 19 (1): 93-99, JANUARY 1978.

Through Carpenter's article, those outside (and inside) the field are invited to witness the first steps of an infant discipline, the philosophy of technology, as it strides independent of the philosophy of science. The report takes the form of minutes recording key debates and exchanges from several major symposia held in 1976. The journalistic approach taken here is appropriate and dramatic.

CASPER, BARRY M. "THE RHETORIC AND REALITY OF CONGRESSIONAL TECHNOLOGY ASSESSMENT." BULLETIN OF THE ATOMIC SCIENTISTS 34 (2); 20-31, FEBRUARY 1978.

The impact of OTA on the politics of technology, especially in regard to the military, is examined. Casper finds "a record of omission"--controversial new programs are consistently ignored. OTA has given no attention to the B-1 Bomber, Liquid Metal Fast Breeder Reactor, Trident submarine, cruise missile program, MX mobile missile, et al. The problem, obviously, is that "the culprit is the master." In reality, technology policy is decided by congressional committees within which "cozy triangles" develop between committees, federal agencies, and related industry where "mutually agreed upon goals" guide action. Carefully directed by Congress, OTA is limited to presenting only pros and cons of issues for which studies are contracted for by Congress. OTA's potential is great, however, but an organizational shakeup is necessary.

HALLEY, RICHARD B.; VATTER, HAROLD G. "TECHNOLOGY AND THE FUTURE AS HISTORY: A CRITICAL REVIEW OF FUTURISM." TECHNOLOGY AND CULTURE 19 (1): 53-82, JANUARY 1978.

In this critical survey of futurism, Halley and Vatter concentrate on the main ideas of futurists regarding technological change and its relation to culture. Whether optimists or pessimists, they believe futurists tend to see the direction of technological change as the determinant of the world to come. Technology is quasi-autonomous, dragging along society and its cultural baggage behind it; society's main business has become adapting to technological change. Yet, paradoxically, the futurist hope lies in the belief that this state of affairs can somehow be reversed- that society will catch up with technology and rein it in. This doctrinal contradiction has been seized upon by some forecasters, notably Daniel Bell, who now recognizes "culture" as another autonomous force. Approaches to the future are diversifying, moving away from complete reliance on the sophisticated, yet naive, computer-based forecasting that filled the early volumes of Futures. Gone also are the days when one could glibly and intelligibly refer to the "technocracy"--the question of who holds power over technology has been reopened. The framework of futurism, as well as its techniques, needs constant review. This thorough paper deserves close attention.

HOFFMAN, KENNETH C. AND DALE W. JORGENSON. "ECONOMIC AND TECHNOLOGICAL MODELS FOR EVALUATION OF ENERGY POLICY." BELL JOURNAL OF ECONOMICS 8 (2): 444-466, AUTUMN 1977.

A model for use in the evaluation of alternative energy policies is detailed. An integration of process analysis and econometrics maximizes inputs and measurements of effects on the system. The econometric component of interindustry transactions includes data on primary input, final demand for nine industry groups, producer and consumer behavior. The process analysis component charts energy flow, conversion efficiencies from extraction of energy source through refining to transformation of energy forms, distribution, and storage. The model also accomodates and assesses the impact of new energy sources and new technologies. An illustration of application of the model to a projection of energy use through 1985 is provided.

IMPACT OF SCIENCE ON SOCIETY, VOLUME 27, NO. 4, OCTOBER-DECEMBER, 1977.

This issue takes a worldwide look at Engineering Education today. The role that engineering education can play in developing nations is emphasized, with several examples. The comparative survey includes the U.S.S.R. and China.

KLEIN, H. ARTHUR. "PETER BRUEGEL THE ELDER AS A GUIDE TO SIXTEENTH CENTURY TECHNOLOGY." SCIENTIFIC AMERICAN 238 (3): 134-40, MARCH 1978.

Bruegel is a master of copious and clear detail. As shown in this well-illustrated article, many of his paintings depict aspects of sixteenth century technology. Through them, the historian gains insights not only into the period's technical processes, but also into the artist's interpretation of the man-machine relationship. In the "Tower of Babel" Bruegel depicts sixteenth century construction techniques. In two series --The Seven Deadly Sins and The Virtues-- weapons, timepieces and period scientific instruments, meticulously rendered, appear as neutral tools aiding the human subjects in their pursuit of vice or saintliness.

STTH: SCIENCE/TECHNOLOGY AND THE HUMANITIES 1 (1): WINTER 1978.

Published by Florida Institute of Technology, STTH is a new journal designed for "the eclectic and the interdisciplinary, for humanists who want to know more of science/technology, and scientists interested in the humanities." Edited by Charmenz S. Lenhart, the editorial board reflects diverse interests with members including Lewis Leary, Ashley Montagu, Frederick Scheibe, Harcourt Brown. The journal will publish articles dealing with the "psychological, sociological and aesthetic relationships between the sciences and the humanities," but research confined to one discipline is also accepted. The premier issue includes considerations of the future of science, energy/ecology interface, science and technology policy, psychology and art, Stein and Goldman as revolutionaries, America as seen by Mayakovski and Esenin. Articles are generally polished and contributors include leaders in their fields, as well as lesser-known colleagues. STTH will appear three times a year; subscription is $8/year from: STTH, Humanities Department, Florida Institute of Technology, Box 1150, Melbourne, Florida 32901.

SCHWARTZ, JAMES M. "LOREN EISELEY: THE SCIENTIST AS LITERARY ARTIST." *GEORGIA REVIEW* 31 (4): 855-871, WINTER 1977.

In his "evolutionary trilogy," *The Immense Journey*, *The Invisible Pyramid*, and *The Night Country*, Eiseley integrates fact, metaphor, and myth-symbols into an "archetypal journey" where science merges with self. An emphasis on the importance of perceptivity and on man's unique ability to *dream* —"to creatively project exterior perception upon interior volition, unifying fact and belief"— reveals the limitations of empirical data. His narrative style evolves from an interplay between dream and reality in which science is seen as offering man only "immediate gratification, not a dynamic futurity." A balance of fact and imagination, literature and science, is necessary for an understanding of nature's evolutionary process, man's physical and spiritual development, and the effects of man's growth on his habitat.

TAYLOR, LANCE; SARRIS, ALEXANDER H.; ABBOTT, PHILIP C. "FOOD SECURITY FOR THE WORLD'S POOR." *TECHNOLOGY REVIEW* 80 (4): 44-54, FEBRUARY 1978.

Among the ideas that emerged from the World Food Conference, the concept of a world grain reserve has perhaps been embraced most widely. Managed by an independent world food security agency, a grain reserve of ten to fifteen million metric tons could do much toward ameliorating the short-term food situation. In time of acute famine, the agency could dispatch needed provisions with speed and without political chicanery. Just as important for food-poor nations, the existence of a buffer might promote price stabilization in years of slight crop shortfalls. The authors hasten to add that the proposed reserve is not a panacea.

TECHNOLOGY AND THE FUTURE OF MAN. *HUMANITAS* 14 (1): ENTIRE ISSUE, FEBRUARY 1978.

Potential changes generated by technology in values, attitudes, and the surroundings effecting man are explored in this special issue. The emergence of a planetary society leads Ferkiss to conclude that "freedom" lies in humanity's ability to control technologies of violence. Agreeing with Heidegger that technology is primarily an attitude, Sabatino considers an understanding of the meaning of technology to be fundamental in the development of humane technologies. Bindewald attempts to integrate the spiritual and artistic with the practical, action-oriented, push-botton world. Caldwell voices the necessity of thorough technology assessment. The "demise of coherent communication" is seen by Davis as a result of the "fragmentation" reflected in the media. Russell and Mehrabian discuss the effect of technological variables on work output and performance. Situating the technological phenomenon in the psycho-social framework of the human condition is Evered's concern in the concluding article. A partially annotated, selective bibliography covering the past ten years is provided.

WALDORP, M. "INDUSTRY IN SPACE: THE REALITY DRAWS NEAR." *CHEMICAL AND ENGINEERING NEWS*, FEBRUARY 20, 1978, PP. 26-31.

Though still an absurdly risky investment for the private sector, space industry almost certainly has a future. How soon it will come about and in what form is less predictable. Looking long-range, space proponent Gerard O'Neill likens the potential of space to that of the mineral-rich, wide open spaces of the old American West. Pragmatic proponents cite the unique processing conditions outer space can furnish: zero gravity, a perfect vacuum, freedom from seismic, acoustic, and convection disturbances; supercold temperatures. Isolated from the earth, the space factory might tackle projects too hazardous to be attempted on the earth. Hailed by some proponents as a Third Industrial Revolution, the advent of space industry is being hastened by American and European research efforts reviewed here.

—Christine Roysdon and Judith Mistichelli
Lehigh University Libraries

Directory of Communication Courses and Programs

by

Sharon Friedman, Lehigh University

Rae Goodell, M.I.T.

Lawrence Verbit, SUNY - Binghamton

(Binghamton, N.Y., 1978)

Increasing numbers of colleges and universities are offering courses and programs concerned with the communication of science and technology to the public. This directory is a basic guide to educational activity in this rapidly expanding field and provides data on 105 courses and 34 programs in 58 colleges and universities. Course information includes title, a short description, type of enrollment, graduate or undergraduate and average number of students, predominant majors, frequency of the offering, and the instructor's name and address. Program data includes in addition to a brief description, the year of founding, number of students enrolled, degree offered, and the director's name and address. The criteria for inclusion are "those courses and programs that appear to have a significant component devoted to teaching science communication to the general public, rather than to business, professional, or other specialized audiences." Includes such areas as basic and applied science, engineering, health and medicine, and agricultural research.

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OPEN FORUM

"Open Forum" is for readers with comments, criticism, and contributions containing material either directly or indirectly usable in the classroom. This includes bibliography and audio-visuals and occasionally announcements of symposia or activities, which in turn might provide useful curriculum ideas. Because of limited space and a fairly long lead-time, we are not always able to include everything that comes to hand. Please keep your contributions coming and we will share as many that timing, space, and content allow. (Editor)

Carl Mitcham, instructor in philosophy and psychology at St. Catharine College, and an editor of the new annual series Research in Philosophy and Technology, has been awarded a grant from the National Science Foundation and the National Endowment for the Humanities to produce an annual, annotated bibliography of the philosophy of technology.

This project continues Mitcham's previous work in this area, namely Bibliography of the Philosophy of Technology (Chicago: University of Chicago Press, 1973) and "Current Bibliography of the Philosophy of Technology: 1973-1974," Research in Philosophy and Technology vol. 1 (1977).

Future "current bibliographies" are now scheduled for succeeding issues of Research in Philosophy and Technology. To facilitate their preparation Mitcham would like to request authors to send him copies of any work they feel should be included in this bibliography, remembering that the bibliography construes the term "philosophy of technology" in a rather wide sense. Readers are also encouraged to submit annotations, especially of foreign language works, and otherwise to contribute comments and suggestions.

All correspondence should be addressed to: Carl Mitcham, St. Catharine College, St. Catharine, KY 40061.

VIDEOTAPES PRODUCED BY THE CITIZEN AND SCIENCE PROJECT

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All tapes are approximately 59 minutes, 50 seconds long. Master tapes are in color; copies (1/2" and cassette) are in color and black-and-white. Copies of all tapes can be obtained from Dora Fortado, Poynter Center, 410 N. Park Avenue.

#732 - KAMEN I - Martin D. Kamen, Indiana University Visiting Patten Foundation Professor of Biochemistry (Spring 1975), Professor of Chemistry, University of California at Los Angeles, and co-discoverer of Carbon 14. Topic: the creative aspects of scientific research.

#383 - KAMEN II - Martin D. Kamen. Topic: Science as an art form and further discussion of creativity in research; exploration of Goethe's excursions into science.

#892 - KAMEN III - Martin D. Kamen. First half of tape is solo discussion by Dr. Kamen of the relationship of science to the American political structure; second half is interview (with Marcel C. La Follette), including reminiscences about the Manhattan Project, E. O. Lawrence's lab at Berkeley in the early 1940's, and the discovery of Carbon 14.

#229 - WOODCOCK I - John Woodcock, Assistant Professor of English, Indiana University. Topic: "C. P. Snow's Two Cultures: Science, Literature, and the Human Condition;" excellent discussion of the relation of the two-cultures concept to the individual citizen.

#913 - MULLINS I - Nicholas C. Mullins, Associate Professor of Sociology, Indiana University. Topic: Current research in the sociology of science, especially on communication among scientists.

#702 - MULLINS II - Nicholas C. Mullins. Topic: The scientific advisory system to government, including Dr. Mullins' discussion of his own current research in this field using the Science Citation Index as a research tool.

PANEL I - Walter Konetzka, Professor of Microbiology (IU), and David M. Smith, Associate Professor of Religion (IU), participants; and Marcel C. La Follette, moderator. Topic: lively discussion and debate on the wisdom and the desirability of control of scientific research, internal and external.

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HUMANITIES PERSPECTIVES ON TECHNOLOGY

Curriculum Newsletter of the Lehigh University HPT Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 6
June 1978

The following article is an extract from a longer address entitled, "Humanities Education: An Organizational Goal for Schools," which was delivered to the Conference on English Education of the National Council of Teachers of English in March. It is reprinted here by permission of the author. Editor

Ironically, in an age which is dominated by science, most humanities curricula have excluded science. Irving H. Buchen writes of humanities programs that "many exclude the physical sciences or bewail the dehumanization of man by technology." Buchen points to the great irony and inconsistency of this, continuing, "Frequently, those who cry the loudest against the evils of technocracy consult concordances put together by computers, cite articles reproduced by Xerox, allude to manuscripts and out-of-print books made available on microfilm and play back Hopi burial chants on audio cassettes." The split between the humanities and the sciences, noted in detail by C. P. Snow in his two cultures speech, remains with us, and in all probability the humanist still does more to maintain the split than does the scientist.

In this regard, however, and of particular importance to the English teacher involved in humanities programs, is Stephen Spender's brilliant insight that "in the famous controversy about the two cultures, one important point seems to have been overlooked--that if there truly is a gap between the literary and the scientific culture, this cannot be bridged by science but only by language. Language is the only means of communication between specialities as far apart as every individual's experience of his own life." Spender continues, "When there is a question of discussing and explaining our experiences of the other arts--music or painting--we use words. If architecture aspires to the condition of music, all human experience aspires to words." This statement, if it has any validity at all, clearly places language at the vortex of all humanities education. James Moffett goes a step further than Spender in his contention that "English, French, and mathematics are symbol systems, into which the phenomenal data of empirical subjects are cast and by means of which we think about them. Symbol systems are not primarily about themselves; they are about other subjects. When a student 'learns' one of these systems, he learns how to operate it. The main point is to think and talk about other things by means of this system." This statement in itself will provide difficulties for many English teachers because it places language so importantly at the center of things, and most English teachers are by training and preference teachers of literature more than teachers of language. But if this statement gives English teachers pause, Moffett's following statement might leave them in a state of utter disrepair: "The most natural assumption about teaching any symbol system should be that the student employ his time using that system in every realistic way that it can be used, not that he analyze it or study it as an object." To teachers bent on explaining and analyzing, this might appear to be the grossest heresy. However, on sober reflection, the reader will realize that Moffett, in this statement, brings students right back to literature in the broadest sense and writing, the two fundamental areas in which they will use the system. However, the English teacher's first duty in the humanities context has to do with language, and this responsibility can be assumed reasonably by no one but the English member of the humanities team. If this person abrogates this responsibility, it is doubtful that humanities education can work.

Northrup Frye has isolated the fundamental reason for students to read works of literature in humanities programs: "Real society," he writes, "the total body of what humanity has done and can do, is revealed to us only by the arts and sciences; nothing but the imagination can apprehend that reality as a whole, and nothing but literature in a culture as verbal as ours, can train the imagination to fight for the sanity and dignity of mankind." These words, lofty and true as they are, must be qualified, because no literature can have the impact of which Frye writes unless it is right for the reader at the time that he/she encounters it. In line with this sentiment, one might recall John Dewey's admonition that, "Knowledge is humanistic in quality not because it is *about* human products in the past, but because of what it *does* in liberating human intelligence and human sympathy." This is not to say that the past is unimportant but rather that man must be at the center of all learning.

One measurement of human development is a person's ability to deal with symbols effectively and to understand the metaphoric meanings which are the undergirdings of all great art, including literature. Bruner tells us, "Metaphor joins dissimilar experiences by finding the image or the symbol that unites them at some deeper emotional level of meaning. Its effect depends upon its capacity for getting past the literal mode of connecting, and the unsuccessful metaphor is one that either fails in finding the image or gets caught in the meshes of literalness." It is doubtful that any approach to learning offers better opportunities for students to move beyond "the literal mode of connecting" of which Bruner speaks than the humanities approach; and the broader and more inclusive the humanities program is, the better are the opportunities for this to occur. The Great Chain of Being of the early philosophers, the interrelatedness of all things in nature becomes increasingly evident as one moves ever more deeply into humanities studies. While one may regard arts and sciences as being at different poles, it is perhaps more accurate and surely more intellectually productive to consider Herbert Read's way of viewing these two areas of human concern: "In the end I do not distinguish science and art, except as methods, and I believe that the opposition created between them in the past has been due to a limited view of both activities. Art is the representation, science the explanation--of the same reality." People whose perception of differences obscures or obliterates their perception of similarities are likely to become stunted in their growth toward recognizing, understanding, and creating metaphors. Anthropologists, according to Hall, agree on three characteristics of culture, the second of which is particularly cogent in the light of Read's statement: culture "is not innate, but learned; *the various facets of culture are interrelated--you touch a culture in one place and everything else is affected*; it is shared and in effect defines the boundaries of different groups."

Everything points to unity, to oneness, even in the face of seeming diversity. Humanities education can bring students and teachers one step closer to understanding the oneness which undergirds society and in so doing can stretch human perceptions to the point that one day people may come to understand more fully their universe and their role in it.

R. Baird Shuman
Dept. of English
Univ. of Illinois
Urbana - Champaign

STS OUTSIDE THE CLASSROOM

A science, technology and society program entails more than course offerings. It entails engaging a wider range of faculty and students than programming emanating from individual disciplines ordinarily allows and engaging them in ways characteristic of the cross-disciplinary nature of the interaction of science, technology and society. Furthermore, it is through extra-curricular programming rather than courses that skeptical or indifferent faculty (and students) can be exposed to the participating STS faculty and to the issues with which they are wrestling. Finally, it seems generally the case that the success of an STS program will be measured in large part by the sense many faculty and administrators develop that the program has changed the intellectual life of their campus in some significant way, has introduced some new intellectual excitement precisely through its penetration of disciplinary barriers; this, too, is primarily achieved through extra-curricular activities, not through courses. In short, every STS program, however modest in size and however young, should see reaching out to the general faculty as an objective of primary importance, ranking not far behind dramatic course offerings. In this article, I would like to describe the extra-curricular activities of Lehigh's Humanities Perspectives on Technology Program during this past year. I do so for two reasons. First, because we think that our programming has been good and we are willing to show it off a bit. Second, to provoke you into sending us descriptions of programming you have attempted, or to suggest changes in ours that you think would improve them. Future issues of the Newsletter will serve as a forum for your responses.

Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

1. The Faculty Supper Series - In my opinion, few activities sponsored by any STS program are as important as those that will encourage a feeling of intellectual camaraderie among interested faculty. To this end, we have a monthly supper for faculty and spouses/friends during the busy part of the Fall and Spring semesters. The supper is preceded by a cocktail hour and followed by a lecture or panel discussion. This past year all of the lectures/discussions were by Lehigh faculty. Next year, with the series having won a substantial regular following, we plan on asking off-campus people to provide some of the presentations. Each attendee pays for his/her own supper. We underwrite the refreshments. To date, the lecturers have performed for the thrill of it all.

We had three suppers in the Fall term and three in the Spring. The Fall lectures were: (1) "The 'Chicken Little' Syndrome in the History of Science" (Steven Goldman, Philosophy) in which it was argued by way of numerous historical illustrations that scientists display an ontological bias, an inclination to make claims about the structure of reality, that is neither demanded by, nor altogether concordant with, their data; (2) "Life at Medical Center: the World as Womb in Science Fiction" (Edward Gallagher, English) in which the positive and negative depictions of technology and nature as competing "wombs" for Mankind were traced through recent science fiction literature; (3) "Ring Around The Rosie, A Dance of Death in 1349" (Linda Heindel, English and Ned Heindel, Chemistry), in which a humanist and a scientist described the response of primarily western European society to the onset of the Black Death in the late Middle Ages.

It is, I think, fair to say that these lectures and the attendant atmosphere went over very well. Each program was fully subscribed (we had limited seating for supper available to us), and each ended with lengthy and vigorous exchanges between audience and speaker(s) and among members of the audience. The very first supper was held at an off-campus restaurant that agreed to give us exclusive use of the facility if we guaranteed a full house (which we did, and had). Agreement was unanimous that this ambience, as well as the meal, was far superior to the on-campus institutional atmosphere of the subsequent suppers. We hope to resume locating the programs in an off-campus restaurant next year.

For the Spring term we again had three suppers. The first was addressed by Judy Mistichelli and Christine Roysdon (Reference Librarians) whose topic was "From Coney to Disney: Technology and Thrills". Mss. Mistichelli and Roysdon described the role of machinery in organizing amusement into centralized parks such as Coney Island early in the century and Disney Land and Disney World more recently, contrasting the styles, the goals and the roles played by technology in these two types of parks. This was an especially rich and provocative topic that had the audience 'on its feet' until closing time, expanding, arguing and testing the speakers' theses.

The second supper was followed by a panel of four faculty members who had prepared critiques of Amory Lovins' book Soft Energy Paths. The panelists were Bruce Dalgaard (Economics), Edward Levy (Mechanical Engineering), John McNamara (Economics) and Roy Herrenkohl (Social Science). While Lovins' book is very "in" at the moment, it is not an easy book for a neutral reader to digest and, on the basis of the argument and its supporting data alone, come away agreeing or disagreeing with it. Unfortunately and unexpectedly, all of the panelists disagreed with Lovins' conclusions and/or with his manipulation of data. Thus, this program, which we thought would lead to the most vigorous discussion period, fizzled in the absence of a knowledgeable supporter of Lovins' position. We should not have taken it for granted that the panelists would disagree among themselves and thereby open the way for broad audience participation.

The last program in the Supper Series was again a joint presentation, "The Many Faces of Hunger". Josef Brozek (Psychology), Eunice Brozek and William Schiesser (Electrical Engineering) detailed the facts of world food resource and distribution problems, the biology, psychology and sociology of hunger, and finally described the use of computer-generated models for projecting the consequences of various courses of action that might be taken to cope with population pressures of food supplies. The subsequent discussion took a surprisingly intense philosophical turn as the roots of tacit consent to humaneness were challenged and defended.

2. The Andrew W. Mellon Lecture Series - Through funds made available by the Andrew W. Mellon Foundation, we were able to bring several interesting people to campus and to allow a large number of faculty and students to have close access to them. We made it a principle of each of our invitations that a Mellon lecturer was expected to spend at least one full day at Lehigh meeting with students in and out of class, and with faculty at dinner and lunch, in addition to giving an evening public lecture, followed by a cocktail party. In this, we took a firm position against "flying visits" by big name speakers whose presence all too often leaves a very transient impression. Again, we tried to choose people who would be provocative because of their ideas and not merely people of fame and/or achievement. The two do not always go together, and we were not uniformly successful.

This year we had three Mellon Lecturers: French historian of technology and architecture Jean Gimpel, M.I.T. computer scientist Joseph Weizenbaum and N.Y. Times science editor Walter Sullivan. Mr. Gimpel, author of The Medieval Machine (among others) gave two public lectures on successive evenings, the first on Medieval technology, the second on Medieval architecture. As there is a loose colloquium in the area of faculty from six local colleges who are interested in matters Medieval, we invited this group to appear as co-sponsors of Mr. Gimpel's appearance (with no cost-sharing obligations) in our publicity and to participate in a dinner for colloquium faculty with the speaker. Mr. Gimpel also had lunch with faculty from the Fine Arts and Architecture Department and addressed several classes in architecture and the history of art.

Professor Weizenbaum, author of Computer Power and Human Reason, went through an analogous regimen. His public appearance, however, was part of an experiment in programming on our part. Even on so relatively small a campus as Lehigh's, it is difficult not to find lectures conflicting with other lectures, performances, exhibits and games. On the night Professor Weizenbaum was to speak, Dr. Tristram Englehardt (Georgetown University) was also to speak as part of a lecture series on medical ethical problems. His subject was the definition of selfhood and as this related in a natural way to Professor Weizenbaum's concern with the ahuman, and perhaps ultimately anti-human, character of the pursuit of artificial intelligence, we suggested that instead of competing for an audience we combine the two programs. Each of the speakers acquiesced and agreed to limit their talks to forty-five minutes each, with the result that the shared audience was certainly larger than either one would have had alone. Furthermore, the contrast of the styles of the two men and the complementary (in part) character of their ideas had an interesting and provocative flavor, especially as they emerged in the active discussion period following the talks.

Finally, Mr. Sullivan had perhaps the most grueling schedule of all. He agreed to stay for a full day after his evening public lecture, which was based on his book treating continental drift, and we coordinated his accessibility closely with Lehigh's journalism and science-writing programs. In addition to dinner and lunch with invited faculty and addressing relevant classes (three of them), Mr. Sullivan was subjected to a coffee hour to which all interested persons were invited.

Mellon lecturers for next year include Nobel Laureate René Dubos and Klaus-Heinrich Standke, Director of the United Nations Office of Science and Technology.

3. We sponsored and organized two half-day symposia on themes that implicated many departments. The first of these was entitled "Designs for Living" and contrasted the philosophies behind three prominent contemporary attempts at applying technology to the design of personal living environments for the middle-term future. A spokesman for Paolo Soleri's notions of urban and personal design presented that position, giving an excellent overview (with hundreds of slides) of Soleri's theoretical and practical projects. A member of a Buckminster Fuller-inspired research group, Earth Metabolic Design, discussed the Fullerian philosophy, and a member of the New Alchemy Institute on Cape Cod gave a moving argument on behalf of that organization's promotion of small-unit, essentially self-sufficient living on and with the earth. The degree of audience involvement with the value suppositions these groups respectively reflected was all by itself worth the price of admission. The program lasted three hours and was just moving into high gear when it had to break up. This kind of a project represents a very fertile opportunity for drawing faculty and students from many different disciplines into an involved discussion of values without the overtones peculiar to discussions of armaments, nuclear power and medical ethics. We learned that much more care in thinking out structural details of publicizing and scheduling such a long program is necessary than we had anticipated. Given the large turnout and enthusiastic audience participation, much more could probably have been done with the three speakers once we had them on campus than we wound up doing with them.

The second symposium was "Science in Music" and was divided into two parts. The afternoon session --which had opened with the premiere performance of a work for 'Cello and taped synthesizer sounds by a composer at Moravian, one of the other local colleges-- was given over (with one exception) to short papers from Lehigh faculty who had a deep interest in music, either personal or professional. Two papers came from the mathematics department (one on the structure of tuning systems, the other on the conceptual similarities between the historical development of mathematics and that of music in the West), one from physics (offering a criterion based on information theory for distinguishing between mediocre and great compositions), one from classics (on the history of Greek music) and one from electrical engineering (on the design of a projected digital music synthesizer with a live-performance capability). One off-campus speaker closed the afternoon program with a talk on the mathematical theory of vibrating plates and its relevance to the design of string instruments. After a supper for participants and their wives, there was an evening program. This again began with a premiere performance of a brass quintet and tape work by a composer at Rutgers University and was followed by a lecture on music and astronomy in the eighteenth century by Dr. Wilbert Jerome, Chairman of the Music Department at Rutgers University-Camden and first oboist with the Philadelphia Orchestra. There can hardly be a more natural vehicle than music for bringing faculty together, particularly when amateur enthusiasts are given the opportunity (and encouragement) to present their pet theses. This kind of a program seems a natural for any campus.

I will close by mentioning one other program we sponsored that was very successful, a week-long science fiction film festival held during the last week of classes late at night, offering students free films and a study break. The films were open to everyone but they were selected because of their relevance to issues that had been raised in the "Technology and Human Values" course that was then drawing to a close (see February Newsletter #4). It is perhaps worth mentioning too that we maintain close and formal contact with the student-run campus radio station which regularly features items relevant to the social impact of science and technology. We provide the station with a subscription to the local newspaper and to Science and with a clipping service for N.Y. Times items of interest.

That was our extra-curricular programming for the year. What was yours?

--Steven L. Goldman
Lehigh University

MODERN SCIENCE AND HUMAN VALUES

A Humanities Course at Penn State University

In an era when rapid advances in science and technology are causing major changes in knowledge and in human lifestyles, it becomes increasingly important to examine how these increases in scientific capability affect people's values and vice-versa. It is the values of individuals which ultimately give direction to the goals of our technological age. These ideas have been examined in "Modern Science and Human Values," a course offered for many years by the College of the Liberal Arts, with several faculty each teaching one or more sections per year. Class size has been held under 30 to encourage class discussion. Each class generally consists of students from a wide variety of disciplines - physical and biological science, engineering, social science, and a few students from humanities. In the description below, I shall emphasize my approach, based in part on the format developed by Warren Miller (Prof. Emeritus of Chemistry and Humanities) over a ten-year period.

Goals

--To examine the impact of science on our lives and on our values through a sequence of readings and discussions on issues drawn from physics and chemistry, biology, and psychology.

--To reduce the vagueness that most people have concerning values and to examine the kinds and structure of values.

--To see the similarities and importance of the major differences between the practice of pure science and the applications of science (i.e. technology).

--To realize that there are many types of technology, e.g. engineering, the practice of medicine, and behavior control, which are based on chemistry and physics, biology, and psychology as kinds of science.

--To realize that the same types of ethical issues and questions arise from these diverse fields, e.g. "Who decides what research should be done?" "Who decides what action should be taken?" "Who will benefit from these actions?" "What are the reasons for the decisions?" "What information should be disseminated to the public?" "How accurate are the data and the interpretation of the data which are being used to support a particular course of action?" "What abuses of scientific information could occur or have occurred?"

--To discover that students from each discipline can learn enough about the other disciplines to enable each of them to argue with each other and with the instructor on some topics and to agree on others.

--To have each student develop their own point of view; and to realize that it is not reasonable to assume that the opinions and views of "authority figures" - e.g. books, TV, world-famous scientists, and the class instructor - are always valid without critical analysis.

Spring Term Booklist (all in paperback)

J. Bronowski, *Science and Human Values*
Ibsen, *An Enemy of the People*
Durrenmatt, *The Physicists*
Marlowe, *The Tragedy of Dr. Faustus*
B. F. Skinner, *Walden Two*
A. O. Lewis, *Of Men and Machines*
Fromm, *The Revolution of Hope; Toward a Humanized Technology*
Eiseley, *The Firmament of Time*
Siu, *The Tao of Science*

Oral Reports

Each student chooses a topic for an oral report from among the following list (they have the option of suggesting one of their own if they prefer): Atom bomb secrecy and Oppenheimer's security clearance; Hardin's tragedy of the commons; the floridation of public drinking water; genetic diseases - determination and control; a possible relation to XYY chromosomes and a criminal tendency; sex preselection; death as a process; I.Q. testing; invasion of privacy; research on humans; Milgram's experiments on obedience to authority; Project Camelot; adequacy of sanity determination.

Each student presented a 5 to 10 minute oral report. These were done in groups of 2 or 3, with each group leading 15 minutes of class discussion following the combined presentation.

Assignments

Reading each paperback before class and discussing it during class. Making an oral report as indicated above. Twc take home written papers, generally of 3 to 6 pages. A written paper based on the oral report, with explicit reference to the topics covered orally by at least two other reports.

Assignments also include 20 "Daily Commentaries." Each commentary is generally based on the reading for that day, although a few of them have been on movies shown in class, and occasionally on a class discussion. Each commentary is to contain 3 statements (and need not be longer than 1 sentence): something in the reading that the student agrees with; something in the reading that the student disagrees with; a reason for the disagreement. The statements may concern the most trivial footnote, or something as important as the theme for the entire book, or anything in-between. The idea is to acquire a habit of mind of being critical. The assignment is also one way of getting the students to read something of the book for that day.

The grade for the course is based on 20 points each for the two papers and the written version of the oral report, and 1 point for each "Daily Commentary."

Class Operation

The dominant mode of instruction in each class meeting is class discussion. A few movies were shown, and occasionally I gave a short lecture on some specific topic. Depending on the book under discussion, we might cover the highlights of the book sequentially; sometimes we responded primarily to questions and comments from class members; sometimes we concentrated on the theme of the book or on issues which should have been raised by the author. We also digressed often into current topics related to the story by the author.

On the first day of class, we held a "values auction" based on a game I learned from a staff member of the Bell Telephone research labs in Murray Hill, N.J. The Bronowski book was used to set the stage for the topics to be covered, and to get the students to begin thinking critically about certain issues and statements.

I used Ibsen, Dürrenmatt, and Marlowe to start the students thinking about the potential responsibility of scientists for their own work, and about the dissemination of information. It was pointed out that atom bomb physicists and genetic engineers have been accused (perhaps incorrectly) of making a Faustian bargain in the sense of seeking infinite knowledge without concern for the consequences.

The Skinner book was used to help the students acquire a feel for a few of the concepts and jargon of behavioral psychology in order to lay some groundwork for later discussions of freedom as a value and for the psychology topics to be covered in the oral reports. The students see that behavioral control is more a technology than a science, and that there are serious ethical issues which must be faced.

The first written paper was due about this time, with students writing on some aspect of who should control what scientific (or technological) activities should be pursued by society.

At this point, 5 weeks of the 10 week term had been completed, and the students began their oral reports. This was the primary vehicle for showing the students that there are common issues among the diverse disciplines and that the students could communicate with each other. Some interesting arguments developed among the students over how fast society should adopt various technological innovations. (I was able to remain in the background for most of 3 two hour class meetings.)

After the reports, we read selected passages in the anthology edited by Arthur O. Lewis (Associate Dean in Liberal Arts), which is a collection of various excerpts relating to automation and technology, with some authors viewing machines as a friend and even essential for human survival, and with other authors viewing machines as a deadly enemy, and perhaps destructive to man. I emphasized the need for using computers, but that they are only a tool operated by man. Too many people accept the results of a computer output without critical analysis. This is especially true with computer models, e.g. those making predictions of resource usage in the future.

The remaining three books were used as an attempt to show the students some alternate ways of dealing with technology. The Siu book relates the different approach of the Eastern mystical tradition to the Western technological tradition.

The students were allowed to choose virtually any topic for their final written paper, but several of them chose one of my suggestions, namely the effect of automation on freedom (thus, tying together Skinner and machines).

Changes and Improvements

The students were almost unanimous in their recommendation that I continue using Bronowski, Ibsen, Durrenmatt, Skinner, and Lewis in the future. They suggested that it would be more efficient to cover the Faustus legend in a lecture rather than using the Marlowe edition. The votes on Fromm, Eiseley, and Siu were split, with some students strongly in favor of one or more, and other students strongly opposed. I will continue with Eiseley, but may switch to *The Immense Journey*. The Siu book did not satisfy me. I am looking for something which suggests that the different characteristics of operation of the right and the left halves of the brain might be related to the different ways that the Eastern and Western cultures have approached the study of science and the use of technology. I have not yet decided whether to continue the Fromm book. Actually, we covered many of his suggestions before we read the book. But, in my opinion, Fromm says them well.

--Philip M. Becker
Dept. of Materials
Science & Engineering
Penn State University

TECHNOLOGY, VALUES, AND SOCIETY

We recently received an update on the new Federated Learning Community in "Technology, Values, and Society" (TVS) being offered to students at Stony Brook (see Curriculum Newsletter #4, p.10) beginning in the Fall term 1978. The following is extracted from the program description.

The Federated Learning Community in TVS provides the opportunity for an in-depth understanding of a problem of broad human significance from the perspectives of six different interacting disciplines. The faculty in the TVS program are Professors Ruth Cowan (History), Theodore Goldfarb (Chemistry), Don Ihde (Philosophy), Jack Ludwig (English), Charles Perrow (Sociology) and John Truxal (Engineering).

The TVS program is designed to increase the student's understanding of the role and meaning of technology in everyday life. The program involves a study of the interaction between society and technology, the ways in which technological change has influenced social change and the ways in which social structure and social values have affected and modified technology and science. Studying the relationship of technology and society in the past provides background for an investigation of this relationship in the present and in the future. Technological effects on the environment and its modification of the quality of human experience will be considered. The values which govern choices will be explored; so will the possible alternative solutions to pressing national problems.

The impact of technology on basic values will be examined through philosophy and literature. The demands of technology upon society and upon the individual's conception of himself/herself will be explored fully, along with those pressures and counter-pressures which create the context for human action, invention and values.

The TVS program offers two integrated semesters, each composed of three federated departmental courses and two specifically integrated activities, i.e. a one-credit Core Course and a variable credit Program Seminar. The Core Course is team-taught by all six of the participating faculty. Specific attention is given there to the nature and relation of disciplines as they interact around the common theme. It is no secret that the disciplines have lost contact with each other and, in some cases, even the ability to communicate. The Core Course attempts to relate and "re-assemble" the disciplines.

The Program Seminar is a new kind of course, the purpose of which is to assist students in synthesizing the material of their other courses. The Program Seminar is a specific and concrete response to the fragmentation and lack of relation which students experience in large universities. Consequently, there is in the Program Seminar no separate material or reading additional to that of the material and reading of the three federated courses upon which it is based; it is like a discussion session with three courses rather than one as its base.

The Program Seminar is taught by a new kind of teacher, a Master Learner (Prof. Marshall Spector, Philosophy), assisted by a teaching fellow, Ms. Juliet Papadakos. The Master Learner is a "master" in the sense that he is already accomplished in one discipline; but he is a "learner" in the sense that he will be going back to classes to study a new interdisciplinary field which he has never studied before. The Master Learner and teaching fellow will attend all the classes as students with the other students enrolled in the program. They will draw upon previous experience to assist students in learning how to learn and will bridge or mediate between the specialized knowledge of the faculty and the needs of the student.

For a student electing to "minor" in the TVS program, she/he will take during the third semester the one-credit Core Course and an independent interdisciplinary study project with two of the participating faculty members.

The specific courses in the TVS program, which will be offered as a federated unit only once, include the following:

FALL 1978 COURSES

PHI 364 - Philosophy & Technology - Professor Don Ihde (Philosophy)

The first part of the course will be a brief survey of long standing philosophical, religious and other cultural concepts which remain guiding concepts governing Western ideas of world or environment and of those which give rise to Western forms of technology.

The second part of the course will undertake a more detailed examination of certain essential features of the human experience of technology. Background readings in recent and contemporary works concerning technology will be related to contemporary experience.

The third part of the course will examine some of the extant predictions concerning the future of technological civilization and relate these to the two previous parts of the course with a consideration of the various likely alternatives which appear for technology both in the discussions of current writings and through the course.

Reading List: (Tentative)

Heidegger, *The Question Concerning Technology.*
----------, assigned readings in *Being and Time.*
Mumford, *Technics and Civilization*.
Lucretius, *On Nature*.
The Bible, readings from Genesis.
Florman, *The Existential Pleasures of Engineering.*
Marcuse, *One Dimensional Man.*

HIS 136 - Technology in History - Professor Ruth Cowan (History)

This course is concerned with the interaction between technology and society, with the mechanisms by which technological change has influenced social change and, similarly, the mechanisms by which social structure and social values have an impact on technology. These mechanisms are illustrated with historical examples ranging from the Middle Ages to the 20th Century; some of the examples discussed are the impact of the plow and the stirrup on the form of the medieval community; differences between French and English attitudes toward technological change on the eve of the Industrial Revolution; organization of work before industrialization and after; the impact of industrialization on family structure and roles; importance of war in technological change; impact of changes in household technology on status of women.

Reading List:

The text for the course is Melvin Kranzberg and Carroll Pursell, *Technology in Western Civilization,* volume one.

ESI 190 - Man, Technology and Society - Professor John Truxal (Engineering)

The course has three principal goals: student understanding of

(a) Current socio-technological problems cannot be treated intelligently without consideration of the total system within which the problem arises. Simplistic solutions are inevitably wrong, and indeed may lead to results exactly opposite from those desired.

(b) Engineering thinking has a strong role in national decision-making, with the position of engineers in government and industry. Rational public decisions on the control of the development of technology require understanding of the viewpoints and concepts of engineering analysis.

(c) Federal and local decisions are frequently based on cost-benefit analysis, benefit-risk analysis, Pareto optimization, and other decision models. Public impact on governmental decisions depends on understanding of these approaches as well as the procedures by which federal decisions are made and implemented.

Reading List:

Technology: Handle With Care by Piel and Truxal to supplement class discussion. In addition, other reading material on current problem studies will be distributed in class.

TVS 325 - Core Course in Technology, Values, and Society - 1 credit - Professors Cowan, Goldfarb, Ihde, Ludwig, Perrow, Spector, Truxal and Ms. Papadakos

This course aims to develop an overview of the problem addressed by the TVS program, and of the issues raised and the resources offered by the six participating disciplines. The course will focus specifically on the nature of academic disciplines, how they relate to each other, and how the common theme is illumined by interdisciplinary study.

Registration for this course is limited to those students enrolled in all three federated courses, i.e. PHI 364, HIS 136 and ESI 190.

TVS 301 - Program Seminar in Technology, Values, and Society - 1-3 credits - Professor Marshall Spector (Philosophy) and Ms. Juliet Papadakos

This seminar will attempt to synthesize the material of its three co-requisite courses, PHI 364, HIS 136 and ESI 190. The agenda of the seminar will be determined by the material covered in those courses and by the problems, difficulties and interests of the students. The course aims to assist students in overcoming the fragmentation of knowledge and in developing their own critical and synthetic abilities.

Registration for this course is limited to those students enrolled in all three federated courses, i.e. PHI 364, HIS 136 and ESI 190.

Reading List:

The readings of the Program Seminar are the same as those of its co-requisite courses. No material additional to those readings will be required.

SPRING 1979 COURSES

CHE 230 - Chemistry in Technology and Environment - Professor Theodore Goldfarb (Chemistry)

An examination of the chemical aspects of the effects that modern technology has on our environment. Some areas that will be covered include: processes affecting air purity, processes affecting water purity, energy development (nuclear and fossil fuels), plastics - production, use and disposal, and occupational health.

Students will have an opportunity to select other areas for study.

The technical chemical aspects of the processes examined will not be viewed in isolation. Considerable attention will be focused on the economic, social and political context in which problems related to the various technologies involved have developed and which affect the search for solutions to these problems.

Students will be encouraged to examine the underlying social values that affect the decisions made by scientists, technicians and politicians concerning environmental problems. The particular problem of the role played by social values in attempts to establish agencies to control and regulate technical activity will be studied.

A knowledge of chemistry equivalent to that expected of someone who has completed an introductory college course (or a good high school course) will be assumed.

Reading List: (Tentative)

Environmental Chemistry: An Introduction by Lucy Pryde Cummings (1973).

In addition there will be other readings including recent newspaper clippings, journal articles and book excerpts distributed in class and assignments in books on reserve in the Chemistry Library such as:

The Closing Circle by Barry Commoner.
The Poverty of Power by Barry Commoner.
The Social Responsibility of the Scientist, Martin Brown, ed.
The Poisons Around Us by D. J. Spedding.
Environment Pollution by L. Hodges.
Chemistry and the Technological Backlash by J. L. Pyle.
Chemistry in the Environment, Readings from Scientific American, Carole L. Hamilton, ed.

ENG 352 - Technology and Imagination - Professor Jack Ludwig (English)

The emphasis will be on the immediate contemporary situation but will work up to the present through a historical review of the past. Science was something done by "odd" and "strange" people outside the consensus santium -- the accumulated wisdom of humankind. A succession of Either/Or's will be considered, starting with God/Devil; The Ancients (Homer, Aristotle)/The Moderns (individual scientists and scientific societies); the Grinds/the Wits; the Sophistocated/the Eccentric; the Artistic/the Measurers; the Sensitive/the Crass; the Conservers/the Destroyers; the Human/the Computerized-Automated-Mechanical. Every crisis involved a choice. In the early twentieth-century the view of technology as grubby and ugly and dangerous and "outside" continued what by now was a tradition of separation and isolation managed by those "inside". the artistic, the religious, the sophistocated, the "human." The contemporary view is much more complicated.

The course will begin with some readings from the late 16th Century and 17th Century --Marlowe, Johnson, Moliere--then go on to the scientist as wacky projector in the works of Swift. Science was less to be feared than ridiculed in the 18th Century. The attitudes toward technology and its presence as industrialization and mechanization in the 19th Century will be approached through Blake, Dickens, Carlyle, Zola, Arnold, etc. We'll look for signs of new questioning, refusals to be trapped by the Either/Or's, reflections on the complexity of technology in the modern world (as refracted in Shaw's Major Barbara), new attitudes to technology in the 1960's and 1970's (following the anti-anti-technology line of McLuhan); technology in the Third World; technology and the media explosion--computer-generated films, multi-track tapes, strobes and hard rock, electronic happenings, op art, popart; technology and the romantic view of drugs and chemicals; technology as a source of language and metaphor rooted in the immediate now. Students will read Eliot, Huxley, Orwell, then go on to Vonnegut, Pynchon, Achebe, Borges, etc.

Reading List:

Selections from: Rabelais, Marlowe, Donne, etc. (mimeographed).
Ben Johnson, *The Alchemist.*
Moliere, *Doctor in Spite of Himself.*
Swift, Book III *Gulliver's Travels.*
----------, Selections from *Battle of the Books.*
Blake, Selections.
Dickens, *Hard Times.*
Carlyle, *Past and Present*, (Selections).
Arnold, *Culture and Anarchy*, (Selections).

Shaw, *Major Barbara.*
Huxley, *Brave New World.*
Orwell, *1984.*
McLuhan, Selections.
Pynchon, *Crying of Lot Forty-Nine.*
----------, two selections from *V.*
----------, *Gravity's Rainbow.*
Vonnegut, Selections.
Achebe, *Arrow of God.*
Berryman, Selections.
Borges, Selections.

SOC 236 - Social Change - Professor Charles Perrow (Sociology)

The course might be titled "Thinking about Technology." The purpose is to develop more realistic, subtle and complex views on this explosive subject. Most agree that some technological change is good, some bad, but beyond that, what causes it to happen? One view is that it is inevitable; modern man strives to learn and control, and we primarily need checks and assessments of impact to shape the process for good rather than evil. Another is that many options are possible, but only some taken because of the interests of dominant elites in society, who choose, create and direct change in their own interests. A third is that both of the above are true in certain areas but others, accident, change, and unintended consequences best explain the selection of technologies and their impact. The three views correspond to some dominant world views--the first emphasizes human nature, the second political power, the third, the disorder of social systems.

We will examine these questions by looking at (a) the origins of the factory system and large corporations in the U.S. in the late 19th Century; (b) the development of ameliorative responses to industrialism such as social welfare programs; (c) the blossoming of the science and technology issue after World War II; (d) and specific technological threats and opportunities of the 1960's and 1970's (nuclear power, space exploration, SST, medical technology, popular culture--e.g. the media and record industries--transportation and so on). The purpose will be to explore the three views and see where each works best.

Reading List:

Some possible books are:

Teich, *Technology and Man's Future.*
Thrall and Starr, *Technology, Power and Social Change.*
Greenberg, *The Politics of Pure Science.*
Kranzberg and Pursell, Selections from *Technology in Western Civilization*.
Marcuse, *One Dimensional Man.*
Braverman, *Labor and Monopoly Capital.*

TVS 326 - Core Course in Technology, Values, and Society - Professors Cowan, Goldfarb, Ihde, Ludwig, Perrow, Spector, Truxal and Ms. Juliet Papadakos

This course is a continuation of TVS 325 and shares the same aim.

Registration for this course is normally limited to those students who have completed PHI 364, HIS 136, ESI 190; and who are enrolled for CHE 230, EGL 352 and SOC 236.

TVS 302 - Program Seminar in Technology, Values and Society - Professor Marshall Spector and Ms. Juliet Papadakos.

The format, readings and requirements of this seminar will be the same as TVS 301, described above, but developed in this instance from the three co-requisite courses of the Spring semester, viz, CHE 230, EGL 352, and SOC 236.

FALL 1979 COURSES

TVS 327 - Core Course in Technology, Values, and Society - Professors Cowan, Goldfarb, Ihde, Ludwig, Perrow, Spector, Truxal and Ms. Papadakos.

This course is the concluding one-credit unit of the three-semester Core Course. Requirements and co-requisites as above.

TVS 487 - Independent Interdisciplinary Study Project - Professors Cowan, Goldfarb, Ihde, Ludwig, Perrow and Truxal.

This culminating activity of the TVS program offers the student the opportunity to do an interdisciplinary independent study project under the direction of two professors. The project, while drawing upon the interdisciplinary base of the program is more focused within the single discipline of the project director than is work done in the Core Course or the Program Seminar. Field components to these projects may be approved.

The SUNY federated TVS program is certainly an ambitious project but seems to have been well thought out. The participating faculty have met weekly during the Spring 1978 semester to plan approach and content. We look forward to reporting on the results, not only of the individual disciplinary courses but in particular the Core and Seminar Courses which will probably be the most difficult to execute, but also the most exciting. Editor

Bruce O. Watkins and Roy Meader

Technology and Human Values: Collision and Solution

Ann Arbor, Ann Arbor Science Publishers,
1978. 174 pages, paperbound, index.

Here is a little book, written in collaboration by a professor of engineering and a professor of English, moderate in both size and point of view, which (one might think) ought to be useful in courses on Technology and Human Values. I regret to report that, in my opinion, its usefulness will be rather limited.

I am not denying its many virtues. No exception can be taken to its theses: technology is here to stay; it is shamelessly used by those who criticize it; though it has caused many problems, many of the problems attributed to it are really the fault of other agencies; governments need technology but rarely consult technologists; some problems are amenable to "technological solutions", others are not; and so on.

In most cases (with the exception of the chapter on history, to which I return) it has the facts straight, and weighs pros and cons dispassionately. The authors are good at short capsule summaries: these are best illustrated in the chapters on Technological Solutions, and Sources of Values, but it is true of the chapters on War, Overpopulation, and Energy as well.

I could wish that the section on Sources of Values which summarized various philosophical systems had consistently related their characteristic tenets to the particular issue of technology. I would likewise like to see a discussion of "technological values" (efficiency, economy, durability, safety, etc.) set beside the discussion of "scientific values" (truth, verifiability, etc.). I do not find a concept of "technology" as the general set, of which science and engineering are subsets, convincing or useful (p. 10). But these are minor blemishes.

The chapter entitled "Shapers of the Present" is, on the other hand, a disaster. After decrying the fact that technologists and scientists have not participated in government (what about Hoover and Carter?), the chapter serves up an incredible hash of historical comments, drawn from a vague Past (everything before the twentieth century) from homo habilis to homo boobus americanus with chronology, culture and context totally confused, facts wrong --the Phoenicians did not invent their alphabet for example-- and interpretations superficial. Historians are chided for not giving enough attention to technological history; the authors deserve rebuke for not utilizing effectively what historical work in this area has in fact been done.

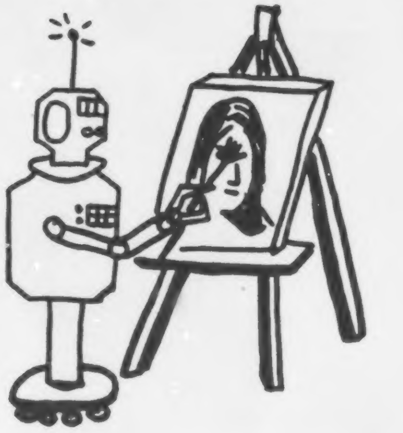
However, the most important fault which vitiates the usefulness of the book as a textbook can been seen throughout the entire book, not merely in one or two unfortunate sections, such as history. That fault is surprising, given the professional orientation of the authors; that is, a nearly chaotic lack of organization which operates at all levels. The book lacks method and system, and so its format suggests that it was generated by tables of random numbers operating on 3x5 cards. Not only is the result confusion, but humanities students are denied an opportunity to see the technological mind at work, rationally assessing the material and bringing efficient solutions to problems. Likewise, engineering students are not shown how a writer of English prose can illumine his material by an intelligent arrangement of logically connected ideas. Nor is communication served by the excessive resort to quotations from all over, which seem to have been extracted from some book of quotations and salted in here and there as a kind of intellectual condiment, rather than chosen as effective illustrations, or compelling expositions of the author's line of thought.

--Douglas Feaver
Dept. of Classics
Lehigh University

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS



HJALTE, KRISTER, KARL LIDGREN, AND INGEMAR STAHL. ENVIRONMENTAL POLICY AND WELFARE ECONOMICS. TRANS. BY CURT WELLS. LONDON: CAMBRIDGE UNIVERSITY PRESS, 1977. 111 P.

The application of theories and tools of welfare economics to the problem of allocation of environmental resources for human needs is explored in this concise study. An analytical framework is developed and applied to a range of environmental problems, i.e. recreation, water resources, recycling, sewage, industrial waste. Protection agencies, institutional systems, and international implications are discussed in regard to the decision/policy-making process. Short bibliography.

HUMMEL, CARL, LYNN LEVITT, AND ROSS LOOMIS. "PERCEPTIONS OF THE ENERGY CRISIS: WHO IS BLAMED AND HOW DO CITIZENS REACT TO ENVIRONMENT-LIFESTYLE TRADE-OFFS?" ENVIRONMENT AND BEHAVIOR 10 (1): 37-88, MARCH 1978.

This extensive report of a survey of the residents of Fort Collins, Colorado examines attitudes, perceptions and behavior toward energy and environmental problems. Of special interest is the focus on "trade-offs" indicated in behavior. Social costs and benefits are distant while personal rewards are immediate, for example, driving a car is pleasurable but reduces energy reserves and contributes to pollution. Data provided on correlations between demographics and attitudes/behavior, predictors of voluntary help, much more. Era of unequivocal support for environmental issues is over.

KAGAN, ANDREW. "LASERIUM: NEW LIGHT ON AN ANCIENT VISION." ARTS MAGAZINE 52 (7): 126-131, MARCH 1978.

Man has attempted an art of pure projected light since medieval times. Ivan Dryer's Laserium works, which combine laser-generated light and music, have an uncanny appeal to the emotions and make abstract art enjoyable to the multitudes. Dryer's Spectra Physics projection unit, with tape decks, "potentiometer dials and joy-stocks" is "played" by the "laserist." Light is projected into a large planetarium dome. Several of the developed shows are described.

MARX, LEO. "REFLECTIONS OF THE NEO-ROMANTIC CRITIQUE OF SCIENCE." DAEDALUS 107 (2): 61-74, SPRING 1978.

Widespread criticism of science is a relatively recent development in the U. S. Emerson was among the first Americans to join European intellectuals in criticizing science and technology's championing of the quantifiable over the affective, social, and imaginative aspects of life. As in the nineteenth century, a spectrum of opinion ranging from hospitable to hostile can be found among twentieth century writers. Among the latter group, Marx believes that Theodore Roszak has made the most systematic effort to formulate a coherent ideology expressing the 1960's dissidents' antagonism toward science. For Roszak, scientific reductionism has resulted in "the single vision," a one-dimensional, utilitarian, impoverished viewpoint. The "psychology of objectivity" has dictated that other modes of perception be ignored or disqualified. The weakness in Roszak's argument, Marx feels, is that his opinions about science are based on an underlying belief that theories of knowledge are prime movers of history. Such a single-factor mode of historical explanation he finds wanting.

MICHAEL, D. N. "TECHNOLOGY ASSESSMENT IN AN EMERGING WORLD." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 11 (3): 189-95, MARCH 1978.

Three major pressures have led to the growth of technology assessment: a growing tendency to re-evaluate the priority of science and technology as a social enterprise, a dawning realization that the survival of society depends on the adoption of a holistic perspective, and increasing demands for citizen participation in planning. Society is in an emergent state; the direction of social evolution, even single factors like birth rates, have proved impossible to predict. Because social change measurement has proved elusive, technology assessment at present cannot be an exclusively rational, formal, technical activity. Nor should it be, says the author. TA's can enjoy a higher function, as incentives to act, even as art forms. "Like art as art, TA's could be the new vitalizers, new direction-givers through transformed myths about the nature of social reality."

MOOS, RUDOLF H. "SOCIAL ENVIRONMENTS OF UNIVERSITY STUDENT LIVING GROUPS: ARCHITECTURAL AND ORGANIZATIONAL CORRELATES." ENVIRONMENT AND BEHAVIOR 10 (1): 109-126, MARCH 1978.

Moos investigates the social climate correlates of dormitory architectural design variables, organizational structure, and campus location. Results of tests administered to 87 student living groups are detailed. Findings include less correlation between size and social climate than indicated in previous research; strong relationship between provision of snack bar or study areas and social cohesiveness/friendship development; more involvement and emtoional support in less centrally located living groups; less involvement and more academic competition in dormitories with a large proportion of single rooms.

MORISON, R. S. "MISGIVINGS ABOUT LIFE-EXTENDING TECHNOLOGIES." DAEDALUS 107 (2): 211-226, SPRING 1978.

Research on aging is a relatively new interest in the biological community. Should this interest continue to grow, Morison believes, there is a distinct possibility that those now living may have their lives extended by several decades. Because advances in medicine have increased the percentage of people who reach old age, society can already anticipate the strains that a population living a decade or so longer would place on resources. A greatly increased lifespan, on the other hand, promises serious social and personal dislocations that the author believes we would prefer not to experience. The greater proportionate population in older age classes could slow the process of social innovation and evolution. Worse, Morison foresees psychological distress guilt, depression, a decline of buoyant youthful illusion.

OTWAY, HARRY J., DAGMAR MAURER, AND KERRY THOMAS. "NUCLEAR POWER: THE QUESTION OF PUBLIC ACCEPTANCE." FUTURES 10 (2): 109-118, APRIL 1978.

As many nations experience intense public opposition to nuclear power, these conflicts create problems for policy makers. The process of risk assessment has been expanded to accommodate the consideration of public preferences, but this information has proved difficult to measure satisfactorily. The intention of this study was to test a methodology that might be used to understand what factors distinguish groups "for" and "against" nuclear power, using an attitude model that includes a belief (knowledge) component and an evaluative (affect) component. Some of the complex findings of the test are surprising. For example, they suggest that people hold beliefs about the benefits of nuclear power independent of beliefs about risks, and that those concerned about sociopolitical risks might not worry about environmental risks.

PRATT, JOSEPH A. "GROWTH OR A CLEAN ENVIRONMENT? RESPONSES TO PETROLEUM-RELATED POLLUTION IN THE GULF COAST REFINING REGION." BUSINESS HISTORY REVIEW 52 (1): 1-29, SPRING 1978.

A look at the seventy-five year effort to control pollution on the Texas Gulf Coast reveals the problems policy makers and enforcers must face in an atmosphere where economic growth is the primary value. Three distinct eras emerge: 1901-1914, unrestrained growth with no regard for pollution; 1914-1940, new production techniques incidentally stem some pollution; 1940-1960s, cirtical pollution leads to government controls on industry. The significant trends which emerge from the study are the move from regional to national pollution control agencies, and the shift in leadership from private to public institutions.

SHARPE, ROGER C., ET AL. PINBALL! NEW YORK: E. P. DUTTON, 1977.

Although informal in tone, this historical survey of pinball provides a comprehensive account of the development of the mechanical amusement from its origins in bagatelle in the late nineteenth century to today's arcades. Detailed diagrams and explanations of such implements as "tilt," "bumpers," and "free play" are provided. Lavishly illustrated with color photographs by James Hamilton, interactions of game, machine, and player are accentuated. The author recognizes his own involvement in a romantic fantasy: "I can feel myself merging with the machine, hands and eyes in perfect coordination. I take a deep breath. . . . Playing pinball is like making love: it demands the complete concentration and total emotional involvement of the player, Nothing else will do." Includes an exhaustive, chronological list of games and manufacturers.

SINSHEIMER, R. L. "THE PRESUMPTIONS OF SCIENCE." DAEDALUS 23-26, SPRING 1978.

Can there be "forbidden" or "inopportune" knowledge, the possession of which would be inimical to human welfare? Sinsheimer cites three types of research which he feels to be of dubious merit: 1) improved means of isotope fractionation 2) contacting extraterrestrial beings (we might be destroyed by a higher civilization) and 3) the investigation of the aging process. Better not to know in the first place, Sinsheimer suggests, than to try to prevent applications of new knowledge later.

WEINBERG, ALVIN M. "REFLECTIONS ON THE ENERGY WARS." AMERICAN SCIENTIST 66 (2): 153-158, MARCH-APRIL 1978.

On the subject on man's future energy sources, there is growing polarization. Two distinctly opposite groups have coalesced: energy "radicals," notably Commoner and Lovins, for whom a small, decentralized, solar-based system is essential, and energy "conservatives" who favor a course dependent on nuclear energy and other "hard" technologies. Weinberg's purpose in this paper is to analyze some of the philosophic and scientific issues underlying the controversy and to suggest a moderate position. Both camps aim for the most efficient use of energy, but differ in the lifestyle tradeoffs they deem acceptable. The solar group in accordance with their favored energy source, desires a diffuse, decentralized, de-electrified society. As Weinberg recognizes, nuclear power sites are more in keeping with our current settlement patterns, but present real and rumored hazards. In the future, we must be open to the use of both sources.

WHITE, GEORGE R. AND MARGARET B. W. GRAHAM. "HOW TO SPOT A TECHNOLOGICAL WINNER." HARVARD BUSINESS REVIEW 56 (2): 146-152, MARCH-APRIL, 1978.

High level managers must accept the responsibility for assessing the merit of a potentially radical technological innovation. A framework for evaluation, based on retrospective study of the transistor and the subsonic jet engine, is presented. Technological potency and business advantage are based on "inventive merit, embodiment merit, operational merit, and market merit." The assessment method is also applied to current developing technologies--the computerized car and the supersonic jet.

--Christine Roysdon and Judith Mistichelli
Lehigh University Libraries

A CORRECTION

Professor Emmanuel Mesthene has written to me ..."I was chagrined to find myself expelled from the philosophical calling in your review of Teich in the August 1977 HPT Newsletter."

May I take this opportunity to express my sincere apologies to Professor Mesthene, who is presently Professor of Philosophy at Rutgers University, for a statement that was both hasty and untrue.

--Douglas Feaver
Dept. of Classics
Lehigh University

ADDRESS CORRECTION

Inadvertently part of the address for the Valuing Simulation game reviewed by Adele Laslie in Issue #3 was dropped. The complete address should read:

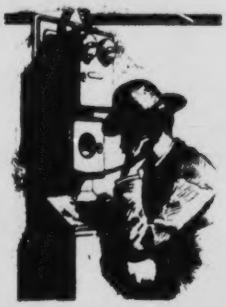
Valuing Simulation
Mobley, Luciani & Assoc., Inc.
16 West 16th Street
New York, New York 10011

We apologize for any inconvenience that this may have caused. Editor.

****

The AAAS Science Education Office has recently published a new Directory of Programs and Courses in Ethics and Values in Science and Technology. Copies are available free of charge from:

Science Education Office
AAAS
1776 Massachusetts Ave., N.W.
Washington, D. C. 20036



A POET'S HOMAGE TO DARWIN

It was Darwin who sprung me loose
Spinning down the evolutionary track
From simian to cell
From whale to worm
Worn by the guise of every geysered aeon
My lit-up brain flashing images
As the Beagle wove its way between far islands
Tracing the evolutionary species backward.
Suddenly there lay all the stratαed layers
Neatly folded in my dazzled mind.

Unfolding them now uses all my days
Though every way back to the earlier me
Is blocked by some wierd creature called by my name
Through our life-locked link with every strangest cell
That at the last has flowed into our genes.
Images! Images! Surely there is no end
To this vocabulary you taught us to spell.
And so I've been learning to write all over again
The endless language you found in our every gene.

William H. Cohen
St. Augustine, Florida

****

CLONE

I will die;
Another will live my life,
Exactly as I have lived,
And it will know as I know;
But it will not know of me,
Of a past beyond its birth;
He will not know he is me,
And alas,
I will not know that I live again,
In him.

John W. Delonas
Lehigh University

EINSTEIN AT THE EMPIRE STATE

At the building's top
the tip of the builded world
I saw you
picture pasted there
in your white sweatshirt
tennis shoes and white cotton slacks,
snow-capped mountain of the mind
flanked by the captains of industry
their ties and tails flapping in the wind.
In the midst of their grasping, triumphant eyes
reality stares from your face
the curved light of distant stars
brought to focus in your lucid pupils.
What heights! What depths
in the hundred million galactic brain cells
you glorified by using.

Hail, lightning-rod tip of the builded world,
Empire State of the mind.

William H. Cohen
St. Augustine, Florida

OPEN FORUM

COMMUNICATIONS COURSE

Sarah Sanderson King, Department of Communication, University of Hawaii, has received a $20,000 demonstration grant from NEH for the development and implementation of a semester course in "Communication Policy and Planning: Alternative Perspectives." The team-taught course to be held in the Fall 1978 (with Professors Richard A. Sanderson, Educational Communications and Technology, and Floyd Matson, American Studies) has as its general purposes--(1) to develop awareness of alternative perspectives in communication policy, planning, development; (2) to examine ways in which we express ourselves through technology and attempt to satisfy our perceived needs; (3) to explore cross-cultural questions in which communication problems and needs can be more fully understood; (4) to consider issues involved in formulation of a communication ethic; (5) to examine influence of new communication technologies on traditional media; (6) to investigate concepts of free flow of information; and (7) to examine samples of country planning in Hawaii, Australia, and Canada.

The course format includes formal class meetings three hours weekly in lecture discussion sessions facilitated by a guided study booklet prepared especially for the course. Students participate in assigned projects in which individually or in small groups they expand topics discussed through research and through their own creativity by applying principles and ideas to a practical examination of their own communication and cultural environment.

An eight-page bibliography accompanies this course description and those requesting this information will be placed on a mailing list for copies of the evaluations made of the course. Material available from the National Institute for the Humanities, at The University of Chicago, 5845 Ellis Avenue, Chicago, Illinois 60637.

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TECHNOLOGY MUSEUMS SPECIAL INTEREST GROUP

The museum committee of the Society for the History of Technology (SHOT) is working toward the establishment of a technology museum special interest group. The purpose of the group will be to facilitate the exchange of information of particular interest to technology museums, to promote the study of artifacts as primary sources of historical information and the use of museum exhibits as teaching materials, to organize sessions at future SHOT meetings and to stimulate the publication of museum exhibit reviews and articles on museum subjects. The organizational meeting will be held during the 1978 annual conference, in Pittsburgh, Pennsylvania, October 18-21. For further information, please write to Ted Penn, Researcher in Technology, Old Sturbridge Village, Sturbridge, MA 01566.

A recent addition to the list of active scholars who would be willing to visit campuses for lectures, colloquia, etc. and their topics includes:

Gordon N. Fleming
Professor of Physics
The Pennsylvania State University
104 Davey Laboratory
University Park, PA 16802

Phone: 814-865-5872

The Philosophical Problems and Implications of Contemporary Science

The Nature and Development of Science and Its Dependence on the Cultural Matrix and Philosophical Atmosphere in Which It Occurs

Anyone wishing to contact Professor Fleming should do so directly.

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HUMANITIES PERSPECTIVES ON TECHNOLOGY

Curriculum Newsletter of the Lehigh University HPT Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 7
September 1978

Engineering 1101:

THE CULTURAL IMPACT OF TECHNOLOGY

For the last three years the School of Engineering and Applied Science of Columbia University has required of all its Freshmen a course with the title of this article, which is given once a week for two hours, has no homework, except the reading of two books, and whose performance is judged by a two hour mid-term and a three-hour final. The course can be taken for two credits, but a third credit can be obtained by writing a critical 15-page review of a book chosen from a list given out by the instructor. The course is attended by approximately 225 Engineering Freshmen and 80 students from the College and other divisions of the University.

The two books chosen as required reading are Bronowski's The Ascent of Man and Commoner's paperback, Science and Survival.

The Faculty advised the instructor that the main purpose of the course should be to introduce the students, who take the same curriculum during the first two years of their attendance, to the various specialties in engineering so as to make them able to choose more consciously their specialty in the first two years. In fact, as the chosen instructor, I decided to extend the scope of the course widely in order not only to explain in some detail what civil, mechanical, electrical and other engineering specialists do, but to indicate the influence of engineering on our society and our culture. It was my main purpose to indicate how this influence can be both positive and negative and to extend the field of this influence not only to our own country but to the world as a whole.

The twelve lectures were thus divided in three or four sequences. The first sequence indicated to the student body the background of the teacher, inasmuch as the course, contrary to all the courses encountered in the School, would have a large content of opinion besides a content of fact. With my degrees in Civil Engineering and Mathematical Physics and my experience in research and teaching on three continents, as well as in universities and in my own consulting office, and with my foreign education and my experience of life under a democratic government, my views could not but be opinionated and, at times, one sided. thus, I was eager to make this clear to the students in order to generate discussion whenever possible.

The second sequence was dedicated to a brief review of the content of the various engineering specialties, limiting them to the main branches of engineering (civil, mechanical, electrical, chemical, industrial, metallurgical and mining). This sequence was illustrated by two or three lectures on special topics given by outside lecturers. The next sequence concerned itself with the practical problems of engineering employment, including the search for a job, the variety of jobs in offices and in the field obtainable in private industry and in various governments, both in the United States and abroad. The head of the Columbia Employment Office assisted this sequence by answering questions from the students. The final sequence dealt with the problems of conflict of loyalty in engineering employment, mentioning examples from recent literature on the subject, and the ethics of the profession. To my amazement the students indicated their complete ignorance of the last two mentioned fields and gave the teacher a standing ovation at the end of his ethics lecture. I mention this to dispel the rumor that present day engineering students are not interested in ethics problems and that they view their profession purely as a way of making money.

During the 1976 presentation of the course, the first four lectures were dedicated to a historical review of the development of engineering, but this review was abolished in the following presentations after a written questionnaire had indicated a complete lack of interest in past history among the students.

The large student body makes it practically impossible to establish a dialogue with the students, while lack of funds and of time make it impossible to split the group into sections in order to discuss problems and ideas with a limited number of students. The large student body also presents difficulty in the correction of exams. These are corrected by graders and spot checked by the instructor.

Nothwithstanding these difficulties, the majority of the students report great enthusiasm for the course which "answers a lot of questions which were on their minds from the moment they entered the school." This statement is confirmed by a few senior students who have expressed to the teacher their regrets at not having had the course during their freshman year.

Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

The students' reaction indicated, once and for all, the wisdom of the decision of the school to require the course during the first year rather than to postpone it to the senior year, as some members of the faculty had suggested. From the viewpoint of the teacher, who has taught in the school for thirty-eight years, this has been by far the most rewarding course, although at the same time the most difficult he has ever taught. The reaction of the students to the lectures has been most positive with about 90% of the attending group obviously listening carefully and taking notes (there is no textbook for the course). At the end of each lecture a large number of students establish a dialogue with the teacher indicating both agreement and disagreement with his ideas and expressing great interest in what they heard. The senior students who attended voluntarily the class indicated that in no other course had they ever investigated the problems and ideas presented in this course and remarked on their importance for their future professional life.

A small number of students indicated their lack of interest in the sequence on the engineering specialties "since they had already decided what kind of engineer they wanted to be." On the other hand, a small number of students indicated their appreciation of the course "since it had allowed them to find out more about other specialties and convinced them to change their initially chosen specialty."

It is obvious that a course of this nature is deeply influenced by the background of the instructor, and that it can take as many aspects as there are approaches to the subject. It is also obvious that one could dedicate to the presentation of ideas on ethics and conflicts of loyalty an entire course, something which is done at Columbia by means of another course, which is elective and attended by ten to twenty students.

The number of courses of this nature being taught in the U. S. has grown by leaps and bounds during the last few years. I believe that each one of them fulfills a great need, but I do not feel that one can establish a set pattern for such courses. It is just as well that, for once, courses in schools of engineering be given from a very personal point of view, provided truth be followed and the relationship between engineering in school and engineering in real life is made clear. This proviso seems to require that the teacher of such a course be at the same time a serious academician, but also an engineer with practical experience in the market place. How easy it is to locate people with such backgrounds, who, in addition, are good teachers, is one of the unsolved problems in the presentation of courses on "Engineering and Society."

--Mario G. Salvadori
James Renwick Professor
Emeritus of Civil Engineering
Columbia University

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NOT A GENRE BUT A MOVEMENT:

SCIENCE FICTION AS A POST-ROMANTIC PHENOMENON

At the Science Fiction Research Association's 1978 conference, it was just one sentence in Robert Scholes's after-the-banquet talk that did it, one sentence that brought me to the "answer" I have been seeking, as a critic of literature and a reader of science fiction, ever since I heard science fiction called a "genre" and felt uncomfortable about the wrongness of that classification. Scholes got it right: "Science fiction is a movement."

Later on, Darko Suvin (moderator of the discussion of "the literary significance of science fiction as a genre" among Ursula Le Guin, Gene Wolfe, Robert Scholes, and Eric Rabkin) repeated that sentence but added the adjective "social." The modification may or may not be related to Suvin's Marxist critical stance, but following some of its implications before taking up the subject that Scholes introduced seems a worthwhile digression.

Long, long ago, in an Empire far, far away, a poet called Horace wrote a letter to some friendly patrons and declared that literature, to be literature, must be *dulce et utile*: must be pleasing, enjoyable, fun, entertaining, and must be useful, informative, educational or inspirational. If one wants to get into aesthetic theory a bit, one can look upon this *dulce et utile* as the descriptor of a hylomorphic entity--the sort of thing that Aristotle explained--and then run into a nasty question: If literature is *dulce et utile* in a hylomorphic sense, then which part is the "matter" and which the "form"? I am not about to offer a definite answer, but I suspect strongly that science fiction is a hylomorphic linguistic entity the *utile* of which is the Aristotelian "matter" and the *dulce* of which is the "form." This suspicion would explain in part the two ways (Suvin's and Scholes's) that science fiction is a movement.

One cannot doubt that there is a social aspect to this movement, the way that there are distinguishable social aspects of, say, Neo-Darwinism and reconstructed-Freud as literary movements. Literary works we designate as "Naturalist" are obviously related to the effects of Darwin's theories on large numbers of people. Similarly, "Freudian" ideas have left their mark on imaginative works of the first half of this century. Painting that is "abstract expressionist" and, for another example, O'Neill's drama are parts of a social movement that we call for brevity, despite oversimplification, "Freudian."

As our cultural system evolves into that which is post-literate, fewer and fewer readers have sufficient experience of the literature of the past to be able to enjoy (and thereby be motivated to read) contemporary works rich in allusions to the literature of the past. Science fiction, however, makes fewer demands on readers' memories of other works and, since its "matter" is the aggregate of information about what is happening now (more and more products are labeled "unsafe for young children" and "hazardous to your health"; we all live aware of threats of nuclear catastrophe, environmental deterioration, and the misuse of machines that could bring our species to extinction), its thematic content is familiar and accessible even to "illiterate" readers. The interplay between this "matter" and the "form" that is literary-imaginative as opposed to expository-factual gives to science fiction a vitality that few perceptive readers can ignore.

Thus, the social aspect of the movement called "science fiction" is all around us: my noticing the brownish sky that extends from Pittsburgh to Chicago while I was flying to the conference in Iowa is, I think in Suvin's sense, an indication of science fiction as a social movement. If it were not a movement, my response could have been "hey, a funny-colored sky" instead of "my God, what pollution." Or, more broadly, science fiction as a social movement is the matrix out of which recycling centers, community compost heaps, the trend toward "natural" foods, and the concern about fossil fuel (the bad effects of internal combustion engines as well as the recognition that petroleum is a finite resource) all arise.

We are afraid of nuclear war. The potentiality of it is quite real, and it is difficult to say which has the greater intuitive-emotional impact: knowledge of atomic destruction and the deadly effects of radiation, or science fiction like William Miller, Jr.'s *A Canticle for Liebowitz* and Judith Merril's "That Only a Mother" which dramatize that intellectual knowledge. As we consider science fiction as a social movement, we can see cultural phenomena like "Warning: The Surgeon General Has Determined . . ." and even a popular song "sung" by a baby seal about to be slaughtered as analogous to the Romantic movement which emphasized individual human worth in literally radical ways.

One of the obstacles we encounter when we try to think of science fiction as a movement is a purely verbal one. "Science fiction" is a noun denoting at the present time some form of prose that is not factual but imaginative, modified by another noun used as an adjective to evoke connotations of sterile but threatening laboratories, knowledge for its own sake, and a host of technological images; it is considerably easier to regard "romanticism" as a movement simply because the word fits. "Science fiction" does not fit, nor does it allow a tidy transformation into an "ism" in language that is clear. This seems to be another one of the problems with English: we have no word that means any kind of verbal artwork (other languages do, but we are forced to translate them lamely and inaccurately into "poem," even when we do not mean verse of any kind). Similarly, we have no word that suffices to communicate the movement of which science fiction (literally: a novel, a romance, a short story) is an indicator. The best I can come up with is "science fiction literature," a term that is cumbersome, redundant, and not quite accurate.

It is not accurate because it does not suggest, as "romantic" and "romanticism" do, a manifestation of a certain kind of cultural sensibility that is the dominant one during a particular historical era. It seems to me that science fiction (the movment, both literary and other) *is* the dominant one right now. If Stanislaw Lem were not considered by most a writer of science fiction, his *The Futurological Congress* would seem to be a "novel" that is well within the contemporary mainstream. From a literary-critical point of view, Lem's works are more closely related to Franz Kafka's (a "mainstream" author) than they are to those by Robert A. Heinlein (who will probably never escape the "science fiction" label, no matter what he writes). Thus, somehow, we must free ourselves from the associations that traditionally cling to the words "science fiction"--associations that would make of it a literary genre--in order to understand how it is, in fact, a "movement" as Robert Scholes has declared it to be.

One simple way of freeing ourselves, at least a bit, is to consider exactly what we are saying or writing when we designate a group of literary works as belonging to a "genre." I have been influenced by Northrop Frye's *Anatomy of Criticism*, so it is natural for me to state that there are four literary genres: the lyric, the drama, prose fiction, and the not-quite-translatable *epos*. (The most obvious example of *epos* is the epic--something that originally was recited by a bard to a present, listening audience--but it seems that today's analogue of the epic is the cinematic film, for it, too, is presented to an audience that is right there in the theater where the pictures are projected and the sounds emitted.) Once we grant this modern variant of *epos* status as a kind or genre of literature, we see that what we call science fiction is only very loosely a "kind" of literature because it actually embraces all four traditional "kinds" or genres.

Ray Bradbury's "Christus Apollo" is as much a lyric as (though in a literary sense inferior to) many of Whitman's poems. Kurt Vonnegut, Jr.'s "Fortitude" is drama--as it is written, a screenplay for cinema or television, but equally viable as a play to be performed before a live audience. Once one admits cinema into the genre of *epos*, one does not have to be reminded of films (especially of the past year and a half) that are cinematic science fiction. Finally, there are the most traditional sub-genres of science fiction--novel, romance, novella, and short story--that belong in the proper genre of prose fiction. If science fiction distributes itself across the lines of genre-differentiation, obviously it is itself more than a genre. If one goes along with Scholes and calls it a movement, one can understand it better (for one thing, there is no longer a need to redefine "genre" to make all kinds of science fiction fit inside) and as a consequence deal with it critically in a consistent way.

Already, serious scholars (Suvin, Scholes, and Robkin among them) are doing this, and one happy result is the distinction between "fan" and "critic." No longer is it necessary (if it ever truly was) to defend *all* science fiction against the onslaughts of those who consider it to be merely "escape reading." Some of it is "escapist," some of it is, for those like myself, simply fun to read despite painfully obvious literary flaws--but this sort of science fiction we do not read because of its formal perfections; nonetheless, some science fiction is literature and can--even must--be read and studied for its own special way of embodying literary excellence. The only major problem with literary criticism of science fiction is that, as a movement, it is in motion and we are a part of the social movement from which it arises. It is not nearly so easy to criticize science fiction as to criticize works which have already, after a century or more, been considered "Romantic" or "Victorian" or "Neoclassical."

Because science fiction is happening now, it is difficult to treat as a literary phenomenon or movement. Nonetheless, we can no longer misuse critical terms like "genre" to describe it, and are left--as we are left by most contemporary "mundane" literature--to seek out likenesses and to guess at trends and to engage in what is really *ad hoc* literary criticism. Many persons (myself included) shudder at the notion that Harlan Ellison's introductions to his *Dangerous Visions* anthologies are true analogues of Wordsworth's prefaces to the *Lyrical Ballads*. But there is some analogy there, and it exists as something for critics of science fiction to explore.

Less traumatic is the pairing of Wordsworth's prefaces with Le Guin's essay, "Is Gender Necessary?" In that commentary on (primarily) *The Left Hand of Darkness*, she reviews the genesis of the novel and explains that it is, like the "thought experiments" of physicists and other scientists, an "experiment" in literature that fleshes out the abstract notion of *H. sapiens*' habitual identification of sex with gender. Her hypothesis is, basically, "What if people were not permanently sex-identified? Her novel answers these questions or, more precisely, it provides us with a concrete verbal made thing which places before us and draws us into a literary or imaginative world, the workings of which are the tests of her hypothesis.

That literature--at least the majority of works in the genre of prose fiction--is likewise a series of "thought experiments" is self-evident. What if a young woman were orphaned, neglected by her relatives, committed to her own standards of integrity, and in love with a man whose married state becomes known to her on the very day of her widding to him? The "answer" or "test" is, of course, Jane Eyre. Or: What if individual persons were demeaned as the result of their being caught in a socially mechanistic and inhuman "Industrial Revolution"? Charles Dickens' works test out that hypothesis and provide some rather strong thematic statements about the inhumanity that came to be excused (by those in power) in the name of "progress." I mention Dickens because his works are very much thematically oriented, just as much science fiction of the present time is dominated by themes of warning against the very probable results of life in a technological culture.

Since "science fiction" (I mean the movement) is going on right now, these speculations are of necessity open-ended. It seems culpably ignorant to dismiss science fiction literature as a freak genre. It is a movement, both literary and social; we are, with or without our consent, a part of it (remember how some people, during July 1969, did not bother to watch Neil Armstrong step from a space vehicle's ladder onto the surface of a world a quarter of a million miles away). Until we admit its existence as a movement, we shall continue to think of science fiction merely as a sub-literary fad, and shall fail to recognize its value as the vehicle for important--one must say, even, vitally important--themes as well as its significance as a pervasive influence on the varieties of literature which our present culture is producing. To recognize science fiction as a movement in many ways similar to the romantic one can at least help us to understand how specific science fiction works are for late-twentieth-century readers exactly what Horace demanded that literature must be.

As one of the panelists in the "Le Guin's Ethics" meeting at the SFRA conference noted (but failed to include with his paper the pages of notes, so I cannot locate the context of the following), Ursula Le Guin has already told us:

> I talk about the gods, I am an atheist. But I am an artist, too, and therefore a liar. Distrust everything I say. I am telling the truth. . . . The novelist says in words what cannot be said in words.

What cannot be said in words is, probably, what it is most important for us to know. Right now, our survival--at some level or another--is at stake. It may be necessary, as it is certainly desirable, for us to listen when the authors of science fiction literature, while they are giving us interesting narratives to read, are also "telling the truth." It may be necessary for the simple reason that, in 150 years or so, literary critics and serious readers will be able (will be alive!) to understand science fiction as we understand Romanticism: as a historical literary and social movement that arises from and reflects the conflict of values which is the identifying attribute of our time.

--Rosemarie Arbur
Dept. of English
Lehigh University

Workbook/cpf

J. D. BERNAL AND THE SOCIAL FUNCTION OF SCIENCE

During the 1930s, the Cambridge crystallographer John Desmond Bernal (1901-1971) played a crucial role in the revolutionary scientific breakthroughs resulting from the application of physics and chemistry to the understanding of biology. He helped to lay the foundations of molecular biology, set the basis for modern protein crystallography, and pioneered virus research. Later, he developed original theoretical approaches for understanding the physical and chemical bases for the origin of living matter.

At the same time, Bernal acted as the cutting edge of an English movement--the Social Relations of Science (SRS) movement--which has profoundly influenced our understanding of the contemporary and historical relations between science, technology, and society. In the context of economic and political crises of the 1930s and 1940s, Bernal and such scientific colleagues as J.B.S. Haldane, Hyman Levy, P.M.S. Blackett, Joseph Needham, Julian Huxley, and Lancelot Hogben attempted to develop, chiefly along Marxist lines, a systematic analysis of science and society that would provide answers to the vital questions of the day.

In their view, a Marxist analysis revealed the unity of the sciences, the close connection between science and technology, and their further unity with social progress. It demonstrated the social and economic origins of scientific progress and the limits placed on science in a capitalist society. It argued for a rational planning of the scientific enterprise and proved the necessity of socialism for the further advance of science. It showed that scientists could not isolate themselves in the laboratory but must engage in political action.

Bernal himself acted as the model for such an engaged scientist. He wrote scores of books, articles, reviews, and letters-to-the-editor to help spread SRS views. He lectured to professional societies, stirred up political rallies (C. P. Snow once called him "the most hypnotizing talker" at Cambridge), and spoke on the radio. He belonged to and helped to organize dozens of political groups, played an important role in the establishment of UNESCO, and served as Presdient of the British Association of Scientific Workers and the World Federation of Scientific Workers. And he did all of this while carrying out first-rate scientific research. As the historian and philosopher of science, Stephen Toulmin, has written, "though it was the poets of the Popular Front era (Auden, Spender, Day Lewis) who took the public eye, the real focus of radical thought in the Britain of the time was among the scientists of Cambridge, and the man at the center of it all was J. D. Bernal."

Bernal's relevance for today's science/technology/society concerns stems from his attempts to create what he called (as early as 1938) a "science of science." Forty years ago, Bernal recognized that "science as a factor in modern society is uncontrolled; what it does and does not do is left largely to chance and to the operation of ill-understood factors. If we are to prevent it becoming uncontrollable and destructive of the very civilization it has built up, we must begin at least to understand how science and society interact.... We need to create a science of science. This means taking our own activity and the social environment with which it reacts as a new field of study." Certainly, the experiences of the past four decades have only sharpened the urgency of this statement.

Bernal's "science of science" rested on two major inquiries. First, an historical basis for the relation of science to society would have to be established--"an aspect of history," wrote Bernal, "which has as yet scarcely been touched." The work of Benjamin Farrington (Science in Antiquity, 1936; Science and Politics in the Ancient World, 1939; Greek Science, Its Meaning For Us, 1944), V. Gordon Childe (Man Makes Himself, 1936; What Happened in History, 1942), J. G. Crowther (British Scientists of the Nineteenth Century, 1935), and J.B.S. Haldane (The Marxist Philosophy and the

Sciences, 1938) all supported this goal. In fact, according to one contemporary commentator, they revealed the "revolutionary importance" of the history of science by demonstrating that "science has always been institutionally tied up with social, economic, and political events, whose irrationalities have retarded and frustrated the possibilities of its unrestricted use for human welfare."

Bernal's own writings in the history of science came much later in his career. Such works as Science and Industry in the Nineteenth Century (1953, 1970), and the major Science in History (1954, 1957, 1965, 1971), and The Extension of Man: A History of Physics Before 1900 (1972) epitomized the Marxist interpretation and contributed to a renewed interest in the previously moribund externalist approach to the history of science. Though Bernal and other SRS writers were criticized by some for twisting historical data to fit a dogmatic Marxist formula, they nevertheless provided an atmosphere in which sounder scholarship along externalist lines has emerged. The beautiful and already classic multi-volume work on Science and Civilization in China now being turned out by Joseph Needham (a charter member of the SRS movement) is only the most prominent current example.

It was in exploring the second basis for a "science of science"--an analysis of the present state and future prospects of the scientific community--that Bernal achieved his most important success. Hard facts on the status of scientific research and teaching had to be collected, analyzed, and presented in a coherent fashion. Specific questions had to be answered: "How many scientific workers are there? How are they financed? What do they do? How is their work coordinated and directed? How is it linked with the satisfaction of human needs and the removal of human evils?" Bernal began this second task in his monumental work of 1939, The Social Function of Science.

The Social Function remains one of the most comprehensive analyses of the actual workings of science and its connection with social and economic development ever produced. In it, Bernal briefly sketched the history of science, described the contemporary organization and efficiency (or lack thereof) of science in Britain, analyzed the teaching and application of science, and compared science under capitalism and socialism. Then he went on to set forth what science might be--the ways in which research and its finance could be reorganized, how science education might be improved, how scientists must play their part to transform society, and on and on. A short list of just some of the chapter titles will give further indication of the enormous scope of the work: "The Existing Organization of Scientific Research in Britain"; "Science in Education"; "Science and War"; "International Science"; "The Finance of Science"; "The Strategy of Scientific Advance"; "Science and Social Transformation".

In today's world of "big science," many of Bernal's concerns, arguments, and proposals in The Social Function seem commonplace. Yet, we must remember that he was one of the first to portray accurately the new position of science in society and to rest his arguments on hard data. Bernal convincingly demonstrated, for example, that "the scale of expenditure on science is probably less than one-tenth of what would be reasonable and desirable in any civilized country." He not only proposed increased funding in many areas, but argued that more attention must be paid to presenting science in a popular form. He pointed to Lancelot Hogben's best-selling Mathematics for the Millions (1936) and Science for the Citizen (1938) as perfect examples of how science could be related to "common needs and aspirations" without sacrificing either accuracy or meaning.

Much of the public controversy surrounding The Social Function concerned Bernal's ideas on the "planning of science." For Bernal, piecemeal "reforms" of the funding of science or training of scientists would not be enough--what was needed was a comprehensive reorganization of the whole scientific enterprise. He argued that pure and applied science must be in close and conscious contact, if either was to be fully developed. Thus, he would establish academies devoted mainly to "pure" (or preferably, "sophisticated") science, technical laboratories concerned chiefly with the solution of practical problems, and institutes to link the two--to assist in the translation of theory into practice. Bernal viewed science as "a circulation of information and activity, as the passing down of ideas from theoretical to experimental scientists, and further, through transformation by technicians into production and new human activity. Conversely, the difficulties of social life and technical production give rise to problems which in their turn stimulate the experimental and theoretical scientists to new discoveries."

The basic unit of Bernal's projected scheme of organization was the "co-operative research laboratory." Here would be combined democratic control from below with intelligent direction at the top. A Laboratory Council would assure that each scientist would see his own work and needs in relation to others in the laboratory, that mutual suggestions and constructive criticisms would be offered, and that "the whole is infused with a greater spirit of fruitful activity."

In The Social Function of Science, Bernal also developed, amplified, and illustrated in more detail many of his previous ideas on the special role of the scientist in bringing about desirable changes in both science and society. For Bernal, it was the scientist's particular duty to counteract "mystical enthusiasms and anti-rational tendencies which are otherwise at the command of all reactionary forces."

Bernal noted that since the mid-nineteenth century, "the idea of pure science" had limited the scientist's responsibility "to carrying out his own work, and leaving the results to an ideal economic system, ideal because natural and open to the free play of economic forces. This is the attitude which still lies at the back of many scientists' and laymen's ideas of science, little though it fits the state of the present-day world."

Reinforcing this apolitical tendency, Bernal asserted, was the "scientific bent," the interest in satisfying curiosity for its own sake, and the "narrowness of vision" induced by an overly specialized education. The increasing dependence of the modern researcher on state support also made it understandable that scientists tended to conform to status quo values and attitudes.

However, the events of the thirties--the economic crisis, the development of socialism in the U.S.S.R. and the rise of fascism in Germany, the preparations for war--forced many scientists to question their traditional role in society. Especially in France and England, Bernal noted, scientists saw that it was "no longer possible...to remain outside." In taking political action, in demanding "that science should take its due place in the creation of a free and humane world," they enhanced, and not diminished, their role as scientists. Bernal's own book certainly worked to reinforce the view that the "work of science does not end in the laboratory."

The Social Function of Science, whose contents have only been barely touched upon above, became a pivot for much debate in the 1940s. As it summarized and climaxed a decade of thinking and writing on the social relations of science, it served as both a Bible for SRS advocates and the chief target for a newly aroused anti-Marxist, anti-SRS group of scientists.

On the one hand was the option that Bernal offered "as far-reaching an indictment of the existing mechanisms and relations of science as was Roger Bacon's attack on the scholasticism of the Middle Ages" which could not "but have an effect on the future management of science, and so on the future of society." C. P. Snow wrote at the time that the book represented "the testament of one of the few men of genius of our time."

On the other side was the Oxford biologist, John R. Baker, who defined "Bernalism" as "the doctrine of those who profess that the only proper objects of scientific research are to feed people and protect them from the elements, that research workers should be organized in gangs and told what to discover, and that the pursuit of knowledge for its own sake has the same value as the solution of crossword puzzles." Michael Polanyi, then a physical chemist at the University of Manchester, asked Bernal: "How can science, if it has to submit to adjustment of its social function, maintain its essence, the spirit of free inquiry?"

Even as Polanyi was writing these words, the social function of science was in fact being adjusted to meet the demands of world war. The direct participation of scientists in government increased dramatically. Bernal's SRS colleague, J.B.S. Haldane, served as a trusted advisor to the Service Chiefs, working with the Army, Navy, and Air Force on such secret projects as anti-invasion preparations and midget submarines. Bernal himself worked with the Ministry of Home Security and the Air Ministry evaluating bomb damage. Later, he became the Scientific Advisor to the Chief of Combined Operations and helped the D-day landing in 1944 by providing detailed beach maps of Normandy. Bernal's personal experiences in helping to forge the new links between science and government made his post-war writings on the subject even more vital.

A final evaluation of Bernal would have to point out that he failed to appreciate the potential for scientific advance in capitalist countries. He gave uncritical support to the approach taken toward organization and research in the Soviet Union. He applied the concepts of dialectical materialism too mechanically to history and to science.

More important, however, Bernal and his colleagues in the Social Relations of Science movement stimulated widespread discussions on the contemporary and historical relationships of science and society. He laid out strong arguments for the organization and direction of science before such ideas were taken for granted and for the social and political responsibility of the scientist before the crisis of the atomic bomb and, later, Vietnam brought many U. S. scientists to the same conclusions. Bernal played a major role in producing, what he called in 1964, "the greatest change in the position of the scientist of twenty-five years ago and today: the greater self-consciousness of science and its position in society, and a greater awareness of its social function."

--Robert E. Filner
Dept. of History
San Diego State University

Bibliography

Other books by Bernal not mentioned above include *The World, the Flesh and the Devil: An Enquiry into the Future of the Three Enemies of the Rational Soul* (1929), *Science for Peace and Socialism* (1949), *The Freedom of Necessity* (1949), *Marx and Science* (1952), *World Without War* (1958), and *The Prospect of Peace* (1969).

There is as yet no full length biography of Bernal. *Society and Science*, edited by Maurice Goldsmith and Alan MacKay (New York, 1964), was published to commemorate the twenty-fifth anniversary of *The Social Function of Science*; it contains a moving portrait of Bernal by C. P. Snow and a retrospective essay by Bernal. Unaccountably, Bernal was not included in the first volumes of the *Dictionary of Scientific Biography*, nor has an essay appeared in *Biographical Memoirs of Fellows of the Royal Society*.

Bernal in the wider context of the Social Relations of Science movement is treated in articles by Robert E. Filner ("The Roots of Political Activism in British Science," *Bulletin of the Atomic Scientists*, XXXII (1976), 25-29; "The Social Relations of Science Movement and J.B.S. Haldane," *Science and Society*, XLI (1977), 303-316) and Paul Gary Werskey ("*Nature* and Politics between the Wars," *Nature*, CCXXIV (1969), 462-470; "British Scientists and 'Outsider' Politics, 1931-1945," *Science Studies*, I (1971), 67-83).

FOLKLORE?

We take a lot of scientific knowledge and technological equipment for granted. This perfectly obvious fact assumed new life for me recently when Jim Frakes called my attention to James Thurber's "The Car We Had to Push" (The Thurber Carnival, pp. 182-89). In this essay you'll find the following passage on Thurber's mother and grandmother:

> "My mother, for instance, thought--or, rather, knew--that it was dangerous to drive an automobile without gasoline: it fried the valves, or something. 'Now don't you dare drive all over town without gasoline!' she would say to us when we started off. Gasoline, oil, and water were much the same to her, a fact that made her life both confusing and perilous. Her greatest dread, however, was the Victrola--we had a very early one, back in the 'Come Josephine in My Flying Machine' days. She had an idea that the Victrola might blow up. It alarmed her, rather than reassured her, to explain that the phonograph was run neither by gasoline nor by electricity. She could only suppose that it was propelled by some newfangled and untested apparatus which was likely to let go at any minute, making us all the victims and martyrs of the wild-eyed Edison's dangerous experiments. The telephone she was comparatively at peace with, except, of course, during storms, when for some reason or other she always took the receiver off the hook and let it hang. She came naturally by her confused and groundless fears, for her own mother lived the latter years of her life in the horrible suspicion that electricity was dripping invisibly all over the house. It leaked, she contended, out of empty sockets if the wall switch had been left on. She would go around screwing in bulbs, and if they lighted up she would hastily and fearfully turn off the wall switch and go back to her Pearson's or Everybody's, happy in the satisfaction that she had stopped not only a costly but a dangerous leakage. Nothing could ever clear this up for her."

Somewhere, sometime, someone had to use what we now take for granted for the first time, and adaptation to the new thing was no doubt not always smooth. I find that Thurber's story humanizes technological change in a delightful way, and I have a feeling that our own families are filled with such true or apocryphal stories which really teach us something about the impact of technology on our lives.

I've learned, for instance, that my own great-grandmother - whom I could only dimly associate with a face in a Gahan Wilson cartoon, the sleepy scent of a warm wool shawl, and the taste of thin rice pudding -- tormented her household for years by surreptitiously pulling the plugs on the electric clocks because they were such a waste of electricity. Now there's an ancestor you can love! And then I had a great-uncle who got out of bed one night to use the outhouse and was never seen again, which only goes to prove, the family wags concluded, that if my great-aunt had an indoor bathroom she would still have a husband. Come to think of it, I have one child who rides, cuddles, and loves our ever-present vacuum cleaner like a family pet, and another child who, not to be left out, "plays" the vacuum cleaner at the same time his older brothers practice their more usual musical instruments. Anybody who has seen Woody Allen fight with a hair dryer in Play It Again, Sam, or Peter Sellers grapple with an institutional vacuum cleaner in Return of the Pink Panther knows the kind of man-machine mal-adaptation I'm talking about. Such "folklore" reminds us in a tensionless way that technology affects real people, people we know, which is not as cliche-ish as it sounds.

—Edward J. Gallagher
Dept. of English
Lehigh University

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As part of an ongoing research and bibliographical project, the HPT Program is interested in other examples of humorous folklore, or leads, resources, and citations for material involving technology as expressed in folklore. If you can help, please send your contribution to Dr. Stephen Cutcliffe, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015.

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TOWARDS A THEORY OF THE HUMANITIES: II

Last November, the University of Southern California was host to a major national conference, supported by the National Endowment for the Humanities and the Rockefeller Foundation, whose theme was the nature of the humanities today and especially their relation to the sciences. In the February issue of this Newsletter, I reported on my reaction to the conference and on the reaction of fifty participants who had replied to a questionnaire that I had circulated to all invitees. One of the questions asked was "What would you have discussed, had you been invited to read a paper at this conference?", and I said in my report that I would soon collate and summarize the responses to that question. I now make good on that promise, although lack of space requires that I brutally condense those responses that ran to several pages. Taken as a whole, the projected topics provide a valuable insight into the concerns and sensibilities of twenty-four prominent humanist academics with regard to the nature of the humanities, the role of the humanities in contemporary higher education and the possible routes to a theory of the humanities homologous with the theoretical foundations of the physical and social sciences. An overview of these concerns strikes me as particularly valuable for people involved in inter-disciplinary coordinations of humanities, science and engineering faculty, that is, for people at work in the field of science, technology and society. For this reason I now present them.

I have loosely grouped the replies around three broad foci of concern, and I have in some cases rephrased the words of the respondents so that each response should seem to be the abstract for a paper to be presented.

I. The Role of the Humanities in Higher Education

C. ALTIERI, University of Washington - The distinctive roles of the humanities with respect to the logoi of Act and Quality need to be delineated. This then allows a statement to be made regarding the sort of truth and/or authority that the humanities can offer to us.

M. COTT, Kansas Committee for the Humanities - How the humanities can bring their characteristic knowledge to bear on non-academic public discussions of important issues facing the citizenry today. (The "rhetorical violence" displayed by many of the USC conference speakers confirms the need for humanists to learn to relate what it is that they know to current conditions of national life.)

T. O. HALL, JR., Virginia Commonwealth University - The professional orientation of faculty and students today distances them from the human in the humanities. This distance needs to be bridged for the humanities to exist in the university.

C. E HUBER, Pacific Lutheran University - The nature and the role of the humanities in higher education needs to be defined. This definition should illuminate the categories essential to humanistic judgement, the moral task of humanistic teaching and the benefits to science, society and individuals of humanistic scholarship.

E. STRENSKI, Mohegan Community College, Norwich, Connecticut - A strategic justification for the teaching of literature is required in a community college setting in which the humanities are besieged by competing vocational and technical interests. Such a justification should involve the status of language, and of symbol systems generally, as means and as ends of human endeavor. (The playful indulgence in nihilism in the conference and the refusal to indulge in honest argument with colleagues shows that there is a crisis of confidence among humanists that needs to be resolved.)

I. STRENSKI, Connecticut College - The actual social setting of the humanities today needs to be delineated. This then requires that we ask how the humanist scholar must adapt to this setting. Scholars now speak as if the humanities were scholarship and not an activity embedded in real world fact and value structures. This Olympian posture is in fact a betrayal of the human.

B. E. WALLACKER, University of California, Davis - The humanist contributes to the enhancement of life through an increased understanding of the True, the Good and the Beautiful. The contemporary surrender to relativistic ethics and situational aesthetics implies the abdication of a humanist's duty with respect to Goodness and Beauty.

II. The Humanities in Relation to the Sciences

P. CLARK, University of Illinois - There are common elements that link the humanities across time and national and cultural boundaries. With these in hand, we can better address the question of what science has to do with humanism.

H. L. DREYFUS, University of California, Berkeley - The hermeneutic method is first defined. It is then argued that an essential difference exists between humanistic fields in which interpretation plays an essential role and the fields of the natural sciences in which it does not.

A. C. NORBERG, University of California, Berkeley - How does the human dimension of science relate the sciences to the humanistic disciplines? How have the sciences and the humanities affected one another? Does the current relationship within the university between the humanities and the sciences and engineering reflect what we believe to be the forms of their historical interaction?

L. V. RYAN, Stanford University - The humanities constitute autonomous enterprises of mind and imagination. If, with this in view, we delineate the disciplinary boundaries of the humanities within the university, we can: (i) add non-traditional and cross-disciplinary perspectives on these enterprises; (ii) avoid combinations with disciplines whose distinct concerns could co-opt or overwhelm the humanistic enterprises.

E. C. STEWART, University of Southern California - Historically, there has been a conflict between the humanism of the humanities and the objectivism of the sciences. This conflict is illuminated by an analysis of the humanities that shows them resting on linguistic phenomena and not on conceptual structures.

III. Towards a Theory of the Humanities

W. F. BLIZEK, University of Nebraska, Omaha - The humanities possess common features that suggest a whole within which particular humanistic disciplines can be located.

D. J. BURTON, University of California, Santa Cruz - Humanistic considerations --history, ambiguity, context of science, possibilities of imagination-- enable the formulation of a critique of the naive, simplistic, linear models of functional and instrumental rationality that give rise to technocracy. These same consierations let us see the limits of intention, rationality, action and let us create, criticize and articulate views of order and freedom, diversity and equality.

H. S. DECKER, University of Houston - Why has the study of history lost significance for students in the last fifteen years? If parallel studies were done for other humanistic disciplines, we might discover trends that would allow some synthesizer to articulate generalizations about the state of the humanities today. This would then make it possible to formulate a meaningful theory of the humanities for today.

R. H. DEMING, State University of New York, Fredonia - In approaching the formulation of a theory of the humanities, we need to consider four things often overlooked by humanists: (i) media other than print; (ii) the quality of humanist involvement in policy decisions; (iii) the nature of the students of the humanities and not just of the professors; (iv) the demise of humanist criticism in our time.

E. C. FROST, California State University, Fresno - A discussion of modern humanistic theories that evolve out of a consideration of the use of myth, archetypal thought, iconology and their aesthetic, social and political implications. These are to be approached holistically, not in the manner of structural and linguistic criticism.

A. GRUNBAUM, University of Pittsburgh - Humanistic concerns illuminate a whole range of enterprises not normally seen as being specifically so illuminated: science policy, law, our understanding of the history of science. This calls for the formulation of a global conception of value and of methods of humanistic scholarship outside of its self-conception.

J. KORG, University of Washington - The common grounds on which the humanities rest certainly include aesthetics, representation, connections within society. Does this imply a contradiction between the currently flourishing humanities of the entertainment world (the instructor as actor) and the currently languishing humanities of the academy?

G. A. LA RUE, University of Southern California - "Humanism" is defined so as to entail an anthropocentric context within which religion, myth, archaeology and history can be explored.

A. PEREZ, Indiana State University - Is a theory of the humanities possible? The humanities speak to the "mystical remainder" of human experience: the unique, the adventitious and the anarchic; also, how these form organic wholes. First it has to be established that a theory of this remainder is possible in spite of its being a trans-scientific remainder. Then a theory of its organization into wholes could be attempted.

S. RENDALL, University of Oregon - The idea of the humanities and of its theory need to be explored from the perspective of their ideological status and function. A Marxist analysis of the humanities so located would be illuminating.

W. F. SOHLICH, University of Oregon - Men who have developed workable notions of human culture and human praxis --among them, Foucault, Gadamer, Habermas, key Marxists-- have contributed significantly to our understanding of science, culture and hermeneutics. What is it that shapes our predominant culture? What moral choices if any do professional humanists make? Such questions are central to any theory of the humanities and the aforementioned critics give us the werewithal to treat them.

C. WALTON, University of Nevada, Las Vegas - A well-conceived theory of the humanities would seize upon what it is that we know of Man and relate that to means of possible personal and social maturation leading to action. Such action would include investigation of the arts and sciences as facets both of the flourishing of the human and of the survival of Man. Thus the humanities are not objects of contemplation but ways of developing and liberating attitudes for coping with prevailing conditions of life. Thus we should ask: (i) which arts today are needed to function as a human being in society and how are these grounded in what we know of Man; (ii) how does the theory behind this relate to particular arts and sciences as actually practiced today.

--Steven L. Goldman
Dept. of Philosophy
Lehigh University

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ABSTRACT

"The History of Science in Undergraduate Education -- Three Approaches" edited by Arthur Donovan. Scan 2, no. 2: 36-41; April 1978.

A symposium on teaching the history of science was held at the annual meeting of the History of Science Society in Dallas, Texas, December 29, 1977. The three speakers described how they successfully introduced undergraduate courses in their own institutions, and distributed detailed outlines and bibliographies. Donovan's report includes long abstracts of the three talks:

(1) "Madness or Salvation: A Course in the History of Genetic Recombination" by Sheldon J. Kopperl, School of Health Sciences, Grand Valley State College, Allendale, Michigan 49401.

(2) "Magic and Medicine, An Introduction to the History of Medicine" by Lois N. Magner, Department of History, Purdue University, West Lafayette, Indiana 47907.

(3) "The Lure of Social and Human Dimensions" by Stanislaus J. Dundon, Department of Philosophy, California Polytechnic State University, San Luis Obisop, California 93401.

Reprints of Donovan's report may be obtained by sending a self-addressed stamped envelope to:

Stephen G. Brush
Institute for Physical Science
and Technology
University of Maryland
College Park, MD 20742

Essays in Humanity and Technology, David Lovekin and Donald P. Verene, editors, Sauk Valley College, Dixon, Illinois (1978). Cost: $3.00

The time of philosophy of technology is hard upon us, and with good reason. With the successful completion of the Viking probes of Mars came the realization that the leading "life-scientists" in the nation could not define what they meant by "life" with sufficient precision to answer the question "Is there life on Mars?" unambiguously. In the context of medical-ethical crises afflicting quite average citizens with distressing frequency, we discover that we have no precise notions of what we mean by "human life", of a "good" life, of "meaningful" or "productive" life, or of when the onset and termination of human life occur. As academics and professional intellectuals respond to problems posed by the exploitation of technologies by identifying culprits within the *technological process* (whatever that is), it becomes clear that we have no very clear notion of what we mean by "technology", particularly as it relates either to science or to the social-political-economic matrix in which it is apparently located.

Well, the art historians and the anthropologists have been working productively for years with vague notions of "style" and "culture", respectively, so that lack of precise definitions is not necessarily a cause for despair. It is, however, a point of entry for reflective analysis, for the reflection that is often called philosophical, as in "philosophy of art", "philosophy of science", "philosophy of law." In a sense, the awareness that some activity in which we have been intensely engaged is problematic represents a coming of age, a maturation, or at least the possibility of a maturation. An activity becomes philosophically problematic when we find that we cannot readily and satisfactorily respond to critical challenges that the activity be justified in terms of value questions raised by its ends and means, and/or that the structure of the activity be delineated in terms of a set of principles governing the conduct of the activity. It is clear enough, then, that the time is right for the emergence of a general interest in philosophy of technology, not just for scholars and certainly not just for philosophers, but for everyone provoked by contemporary problems from whose cause and solution technology cannot be separated. It is only necessary to emphasize that the term "problematic" refers to a state of mind --to a "software" problem, not a "hardware" problem-- and to emphasize as well the reflective character of that state of mind, in order to establish the legitimacy of the association of philosophy with technology.

With these brief comments for background, I would like to claim that a philosophy of technology course, perhaps as a follow-up to an introductory survey course in technology and human values, is appropriate and within the grasp of any institution, certainly any institution with courses in the area of science, technology and society. The Lovekin-Verene collection of essays would be a very attractive text for such a course, in spite of being the proceedings of a conference, held at Sauk Valley College in the Spring of 1977. The value of the essays lies in their being provocative, in the inevitability that they will raise up in the minds of all students dramatic new dimensions of the dynamics of technology in human affairs generally and Western culture in particular. Granted, the collection is not unique in this regard. What marks it out is its brevity and the range of issues raised by its six papers. It is hardly a secret that the average college student finds readings in philosophy a burden to be borne only when unavoidable. These essays are philosophical without the rhetorical trappings commonly characteristic of writings in philosophy and this, too, makes the collection worth looking into, at least by anyone contemplating a first course in philosophy of technology.

The six papers collected here are by Edward Ballard ("World and Culture"), Lionel Rubinoff ("The Metaphysics of Technology and the Crisis of Rationality"), Donald Verene ("Technique and the Directions of the Human Spirit: Laughter and Desire"), Langdon Winner ("The Political Philosophy of Alternative Technology: Historical Roots and Present Prospects"), Henry W. Johnstone ("The Categories of Travel") and David Lovekin ("Degenerate Travel: The

S. RENDALL, University of Oregon - The idea of the humanities and of its theory need to be explored from the perspective of their ideological status and function. A Marxist analysis of the humanities so located would be illuminating.

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"The History of Science in Undergraduate Education -- Three Approaches" edited by Arthur Donovan. Scan 2, no. 2: 36-41; April 1978.

A symposium on teaching the history of science was held at the annual meeting of the History of Science Society in Dallas, Texas, December 29, 1977. The three speakers described how they successfully introduced undergraduate courses in their own institutions, and distributed detailed outlines and bibliographies. Donovan's report includes long abstracts of the three talks:

(1) "Madness or Salvation: A Course in the History of Genetic Recombination" by Sheldon J. Kopperl, School of Health Sciences, Grand Valley State College, Allendale, Michigan 49401.

(2) "Magic and Medicine, An Introduction to the History of Medicine" by Lois N. Magner, Department of History, Purdue University, West Lafayette, Indiana 47907.

(3) "The Lure of Social and Human Dimensions" by Stanislaus J. Dundon, Department of Philosophy, California Polytechnic State University, San Luis Obisop, California 93401.

Reprints of Donovan's report may be obtained by sending a self-addressed stamped envelope to:

Stephen G. Brush
Institute for Physical Science
and Technology
University of Maryland
College Park, MD 20742

Essays in Humanity and Technology, David Lovekin and Donald P. Verene, editors, Sauk Valley College, Dixon, Illinois (1978). Cost: $3.00.

The time of philosophy of technology is hard upon us, and with good reason. With the successful completion of the Viking probes of Mars came the realization that the leading "life-scientists" in the nation could not define what they meant by "life" with sufficient precision to answer the question "Is there life on Mars?" unambiguously. In the context of medical-ethical crises afflicting quite average citizens with distressing frequency, we discover that we have no precise notions of what we mean by "human life", of a "good" life, of "meaningful" or "productive" life, or of when the onset and termination of human life occur. As academics and professional intellectuals respond to problems posed by the exploitation of technologies by identifying culprits within the *technological process* (whatever that is), it becomes clear that we have no very clear notion of what we mean by "technology", particularly as it relates either to science or to the social-political-economic matrix in which it is apparently located.

Well, the art historians and the anthropologists have been working productively for years with vague notions of "style" and "culture", respectively, so that lack of precise definitions is not necessarily a cause for despair. It is, however, a point of entry for reflective analysis, for the reflection that is often called philosophical, as in "philosophy of art", "philosophy of science", "philosophy of law." In a sense, the awareness that some activity in which we have been intensely engaged is problematic represents a coming of age, a maturation, or at least the possibility of a maturation. An activity becomes philosophically problematic when we find that we cannot readily and satisfactorily respond to critical challenges that the activity be justified in terms of value questions raised by its ends and means, and/or that the structure of the activity be delineated in terms of a set of principles governing the conduct of the activity. It is clear enough, then, that the time is right for the emergence of a general interest in philosophy of technology, not just for scholars and certainly not just for philosophers, but for everyone provoked by contemporary problems from whose cause and solution technology cannot be separated. It is only necessary to emphasize that the term "problematic" refers to a state of mind --to a "software" problem, not a "hardware" problem-- and to emphasize as well the reflective character of that state of mind, in order to establish the legitimacy of the association of philosophy with technology.

With these brief comments for background, I would like to claim that a philosophy of technology course, perhaps as a follow-up to an introductory survey course in technology and human values, is appropriate and within the grasp of any institution, certainly any institution with courses in the area of science, technology and society. The Lovekin-Verene collection of essays would be a very attractive text for such a course, in spite of being the proceedings of a conference, held at Sauk Valley College in the Spring of 1977. The value of the essays lies in their being provocative, in the inevitability that they will raise up in the minds of all students dramatic new dimensions of the dynamics of technology in human affairs generally and Western culture in particular. Granted, the collection is not unique in this regard. What marks it out is its brevity and the range of issues raised by its six papers. It is hardly a secret that the average college student finds readings in philosophy a burden to be borne only when unavoidable. These essays are philosophical without the rhetorical trappings commonly characteristic of writings in philosophy and this, too, makes the collection worth looking into, at least by anyone contemplating a first course in philosophy of technology.

The six papers collected here are by Edward Ballard ("World and Culture"), Lionel Rubinoff ("The Metaphysics of Technology and the Crisis of Rationality"), Donald Verene ("Technique and the Directions of the Human Spirit: Laughter and Desire"), Langdon Winner ("The Political Philosophy of Alternative Technology: Historical Roots and Present Prospects"), Henry W. Johnstone ("The Categories of Travel") and David Lovekin ("Degenerate Travel: The

World of the Tourist in Technological Society"). In recommending this book, I apply a criterion in the selection of texts that can hardly be unique to me. I often look for a book the reading of which will provoke argument and raise different sides to controversies, as opposed to a book that will reinforce the side that I personally support. Thus, there is much in these essays with which I disagree, but they will, I am confident, generate discussions of a broad nature within which what I "profess" on these matters can in a natural way find its place.

Ballard's essay is a particularly good one, I think, in that it forcefully defends the thesis that there is an ineluctably subjective dimension to what we mean by "world", as in "the world in which we live", "the external world", et cetera. There is a continuing interest in mythology and in religious (especially mystical) symbolism, and Ballard provides a framework for exploring this as well as contributing some valuable insights of his own.

Henry Johnstone's paper is also particularly good, because it is authentically philosophical while addressing what seems to be an eminently non-philosophical topic: travel. Johnstone, and Lovekin after him, explores the categorial structure of the experience of travelling, in the process displaying an example of the reflective analysis of experiences and states of mind, that is, displaying the doing of philosophy and without doing it in the often forbidding way that technical philosophy is done. This display readily becomes the basis of a scheme for reflective analysis that is transposable to other issues in the area of technology and human experience of the world.

Langdon Winner's essay, though I would argue with many specific claims, makes the very valuable point that the clamor for appropriate technology is essentially a political movement in spite of seeming to offer itself as a call for better engineering. Besides exploring Winner's theses --for example, that alternative technology groups are revivals of nineteenth century utopian idealism, that the ambiguity of "appropriate" and "alternative" are not likely to clear up in practice, that nineteenth century idealism is not transposable to the late twentieth century-- the instructor can make explicit the political and the religious character of much of contemporary opposition to "high" technology, two cases in point being the religious foundations of the work of Francis Schumacher and Paolo Soleri.

Lionel Rubinoff comes closest to a traditional philosophical essay, arguing that a focus upon the functional rationality that solves problems is an irresponsible flight from the creative rationality that generates values in the process, articulating ends and authenticating means. There is a simplistic contrast here of Promethean Man, "properly" employing science and technology in the service of human advancement to human goals, and Faustian Man, bending human activities to abstract scientific and technological ends, but again the issues are all raised here for an instructor to enrich in his/her own way. This is also the case with Donald Verene's elaborate argument on behalf of the tension between technology and the sensuous dimension of human existence: imagination, laughter and desire. Verene draws Jacques Ellul, Giambattista Vico and the Marquis de Sade into a plausibly common cause and in the process startles the reader into examining the depths of technology's penetration into the details of our lives.

For the size and the price, this collection of essays ought not to be ignored as a potentially effective teaching tool in a course that is likely to become increasingly common in the next few years, and justifiably so: a non-technical, no prerequisites first course in philosophy of technology. It is a healthy sign of the times that the conference at which these papers were delivered was followed by a second conference in the Spring of 1978. The papers of that second conference are also to be published by Sauk Valley College.

--Steven L. Goldman
Dept. of Philosophy
Lehigh University

SHOVELING OUT SU

The following article appeared in the Syracuse University Alumni News magazine and is herein reprinted with the permission of the author and the Alumni News. Perhaps this will help you keep your cool in the early semester heat of the things. Editor

"When people ask 'What will they think of next?' we're the ones people are talking about," mused James J. Pirkl, professor of industrial design at SU's College of Visual and Performing Arts. What have they thought of this time? A new, more efficient, easier-to-use, "humane" snow shovel.

Twenty-two students in Pirkl's product design development course tried out new shovels on the quad one snowy March afternoon. Passing students stopped to observe as the designers demonstrated their class assignment to design and construct a snow shovel that could be used easily and efficiently by everyone.

The challenge was to improve the conventional snow shovel, which doesn't meet the special needs of certain people. The shovels were designed with these people in mind: the elderly, with back trouble or arthritis; car owners, who have to shovel under their cars; and hired shovellers who want to get the job done fast.

One student-designed shovel enables you to lift the snow without bending over. Another has a pivoting scoop so you don't have to twist your back. Another pushes the snow like a plow, then helps lift the heavy snow for you.

"The premise of this project was that the existing snow shovel is hostile to a large segment of the consuming public," explained Pirkl. All products have potential "bugs" that can irritate people, he said. "We try to forsee all the bugs and then try to design out the bugs." The product design course relates the product to the user. By designing with "humane performance" in mind, the student designers hope to "eliminate aspects of snow-shovelling that bug people."

In the 13 years that Pirkl has taught this course, his students have designed such make-believe products as wheelless velocipedes (small vehicles), footmobiles, minimal boats (using the least amount of material to keep afloat), elasticarts (powered by plastic tubing) and humane mousetraps (that capture the unsuspecting critters without killing them). The course focuses on "problems in consumer areas where no product solution has ever been offered," Pirkl explained.

Industrial designers have three main concerns, Pirkl said: how the product looks, how it functions and how it suits the consumer. Creativity alone is not enough for a new product design, he said.

There's a growing trend towards products that better consider utility to the consumer, Pirkl said. "Industrial design of tomorrow will be more sympathetic to the needs of the consumer," Pirkl foresees. "Because the consuming public is fed up with inhumane products, today it's good business (for manufacturers) to come up with products that aren't hostile to their users." Designers of humane products--which Prikl trains his students to be--will be highly sought in the future," he said.

--Jean Mielke

RachelBurger/CPF

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BEUM, ROBERT. "LITERATURE AND *MACHINISME*." *SEWANEE REVIEW* 86 (2): 217-44, SPRING 1978.

While many writers from the early nineteenth century to the present have been receptive to the literary possibilities of machines, technological progress, and urbanisation, those who move from a perception of the machine itself to a consideration of its effect on civilization develop metaphors and symbols that suggest the negative, monotonous, ominous, or destructive. Writers dealing with "machinisme" see that to accept the machine with affirmation parallels the irresponsibility of the scientist who ignores the consequences of his work. Even science fiction fails to affirm technology. Machines are often villains or symbols of evil designed to contrast with pastoral tradition. The development of anti-technological and antimaterialist literature constitutes "true progress."

FLORMAN, SMAUEL C. "TECHNOLOGY'S MINOR MOMENTS; THE HIDDEN BENEFITS OF NOT SUCCEEDING." *HARPER'S*, JUNE 1978, P. 16-19.

A look at the factors which determine the success or failure of new technologies provides reassurance that there is no technological imperative. While the rotary engine and the process "fluidics" succumbed because of a changing environment or the rapid evolution of a competing technology, the fate of many innovations is keyed to the ego-related behavior of corporate executives. Once produced, failures are often the result of ill-conceived notions of the wants and needs of the public. For example, electronic facsimile transmission (long-distance xerography) has not been a big seller because our sense of "urgency" was overestimated. Man still has the reins.

FOX, SIV CEDERING. "THE COMPUTER TERMINAL." *PARTISAN REVIEW* 45 (2): 223-31, 1978.

This short story concerns a woman writer who composes on a computer terminal. The computer stores, reorganizes paragraphs, and guards privacy, but it also begins to interact imaginatively by reminding its human operator of her dreams, and the psychological problems of her family members. It then advances to predicting future events. Instinctively, the writer attempts to restore her mental stability through traditional household chores and walks with the dog. The tactics are unsuccessful, and remaining highly disturbed, she finally "deletes" all of her compositions.

MC HALE, JOHN. "THE FUTURE OF ART AND MASS CULTURE." *FUTURES* 10 (3): 178-90, JUNE 1978.

The advent of mass culture has been linked to technologies of communication, i.e. radio, television, cinema. Although there are few historical precedents from which to extrapolate the future directions of mass culture, some changes in art and society can be argued. Mechanical reproduction has de-materialized the artifact so that art is no longer "in the frame." It moves toward combines, happenings, and lifestyles. Communication and information technologies alter the concept of mass culture from vertical levels to horizontal interaction, and broaden the concept of art until it includes even the work experience.

MEEKER, JOSEPH W. "THE IMMINENT ALLIANCE: NEW CONNECTIONS AMONG ART, SCIENCE, AND TECHNOLOGY." *TECHNOLOGY AND CULTURE* 19 (2): 187-98, APRIL 1978.

There are indications that science and art, separated for four centuries, are about to be reunited with technology guiding them. New ways of thinking include the realization that conquering Nature is self-destructive, a recognition of the non-reliability of objectivity, the discovery of analytic and synthetic brain hemispheres. The reunion will occur because it is needed. Artists and engineers need to understand the nature and form potentials of their materials, art transforms technology into symbolic expression. Scientists have freed themselves from the language of machines and are thinking in metaphoric images. New forms evolving will be "adaptive, not triumphant." Superb; don't miss this one. Could be extremely effective as an introduction to interdisciplinary thought.

MISHAN, EZRA J. "WHATEVER HAPPENED TO PROGRESS?" *JOURNAL OF ECONOMIC ISSUES* 12 (2): 405-25, JUNE 1978.

The idea of progress, which encompasses the forces of knowledge and wealth, has been institutionalized by the "Established Enlightenment," composed of members of the middle class intelligentsia, the professional classes, the scientific and academic community. While the credits of progress are undeniable, it runs counter to human needs of physical activity, security, love, trust, self-respect, group belonging. Progress "saps the spiritual sustenance of man." To illustrate, Mishan briefly discusses the social costs of the automobile and other transport technologies. Our civilization will not be saved by the young because they too are "maximizers," plunderers with "unchecked gluttony" in regard to self-indulgence. A move away from the growth path is not politically feasible because of conventional rationalization, entrenched interests, and international distrust.

THE MODERN NOVEL AND THE CITY. *MODERN FICTION STUDIES* 24 (1): ENTIRE ISSUE, SPRING 1978.

Among the ten studies comprising this special issue are an investigation of the changing function of the city in literature, an analysis of the city in modern Jewish novels of Kafka, Roth, and Amos Oz, a study of Howell's characterization in *A Modern Instance*, a consideration of Crane's vision of the "hysteria" of city reality in *Maggie*, the Chicago of Saul Bellow. The issue concludes with a checklist of studies of the modern novel and the city.

WOODCOCK, JOHN. "LITERATURE AND SCIENCE SINCE HUXLEY." *INTERDISCIPLINARY SCIENCE REVIEWS* 3, NO. 1: 31-45, 1978.

Surveying recent responses to the "two cultures" debate, Woodcock looks at critical, narrative, and fictional treatments. In *Literature and Science* Huxley found distinctions between the fields in areas of function, psychology, language, and most obviously in their respective interests in private and public experience. Critical considerations discussed include works by Bronowski, Snow, Skinner, Goodman, and Boulding. Among the fictional approaches, which focus on the uses of science/technology and its social impact, are novels and science fiction by Bellow, Vonnegut, Asimov, Brunner, Clarke, LeGuin, and Pynchon. Watson and Mailer have produced journalistic narratives which serve as cultural impact statements for scientific events. Poets and essayists are also discussed. Extensively documented. (Reprints of this article are available from the author at the following address: Dept. of English, Ballantine Hall, Indiana University, Bloomington, Ind. 47401).

--Judith Mistichelli
Lehigh University Library

OPEN FORUM

A recent addition to the list of active scholars who would be willing to visit campuses for lectures, colloquia, etc. and their topics include:

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Associate Professor
School of Journalism and Mass Communication
The University of Georgia
Athens, GA 30602

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Anyone wishing to make arrangements with Professor Eberhard should do so directly.

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HUMANITIES PERSPECTIVES ON TECHNOLOGY

Curriculum Newsletter of the Lehigh University HPT Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 8
November 1978

LIGHT AND VISION: AN INTERACTIVE COURSE IN SCIENCE, TECHNOLOGY, LITERATURE AND THE ARTS AT WPI

Introduction

Placing the development of modern science and technology within the larger frame of intellectual and esthetic change has been a major responsibility of WPI education since 1970. In the spring of that year the WPI faculty voted to abolish its conventional engineering and science program (which based graduation on the accumulation of course credits in specific areas) and in its place adopted the WPI Plan, which grants the BS degree upon the demonstration of competence as measured in four degree requirements. Two of these requirements--a major project and a competency examination--are in the student's major field. The third degree requirement is a thematically-related individually-selected sequence of five humanities courses followed by a cumulative independent study. The last requirement, perhaps the most innovative, is a major interactive project, involving the student in defining, researching, and reporting on a topic which demonstrates how science and technology interact with the culture which both creates them and is in turn shaped by their impact.

In order to encourage students to choose interactive projects relating the humanities to technology, in the early 1970's a varied group of faculty--two from chemistry, and one each from mechanical engineering, physics, life sciences, history of science and literature--secured funding from the General Electric Foundation to develop appropriate project topics. Over the next two years, this group, which came to be known as the "Group for Integrative Studies," provided a small number of students with topics for their interactive degree requirement. Though the variety of project topics developed was encouraging, the GIS soon discovered that its slant towards philosophy, esthetics, and history attracted a small clientele; most students understandably were attracted to more pragmatic and topical concerns like technology assessment, hazards and consumer safety analysis, and ecological and environmental planning.

Furthermore, many students thought themselves incapable of performing the cross-disciplinary integrations which were the focus of the GIS project. To encourage greater student participation, in 1973 several faculty in the GIS proposed using the remainder of the GE funds for summer development of a course which would introduce students to methods of analyzing how changes in scientific concepts occur within cultural and intellectual contexts. Such a course would prepare students to engage subsequently in the more advanced work of the interactive project. After some reflection, the topic chosen was "Light and Vision" because of the range, immediacy and inherent interest of material available for study. In addition to studies of the history of optics and physiology, topics from mythology, religion, philosophy, art, literature, and language all lent themselves to illustrating the interactions among different points of view in the study of the major theme.

A full month's summer support in 1973 enabled eight faculty (from history of science, mechanical engineering, physics, chemistry, life sciences, and literature, plus a staff member from the Worcester Art Museum) to develop the structure and content of the course. Breaking down the disciplinary barriers of the faculty was an important and often exhausting task. That summer saw the resolution of a major issue dividing the group along disciplinary lines: how should contemporary ideas on light and vision be presented in the course? As the modern culmination of history's progressive winnowings, or as concepts as culturally and historically bound as their predecessors now seemed to be? Though some members in the group were predisposed to the former approach, consensus for the latter was achieved in the belief that a presentation which assumed the correctness of modern concepts would make earlier ideas too often appear as dead-ends and curious fossils. Furthermore, this approach would fail in a major goal of the course: making students aware of how larger intellectual constructs (e.g., Greek idealism *vs*. modern empiricism) affect the kinds of questions science asks, and thus delimit the kinds of results found and the theories derived. By always reminding the students that scientific ideas about light and vision are congruent with the larger intellectual assumptions of the time and place producing them, we hoped to focus awareness upon the cultural paradigms which shape scientific thought and to implant a useful scepticism about the immutable correctness of modern ideas.

Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

The final plan for the course (which was first offered in spring 1974) clustered the material around three major periods of transition: 1) from Egyptian and Babylonian myths to Greek philosophy and science, 2) from late medieval art, religion, and technology to Newton and the effect of his work on light on poets and scientists, and 3) from late nineteenth century physiology and impressionism to modern biology and physics and cubist and OP art. To introduce students to ways of thinking across disciplines, we have relied more heavily each year on a formal discussion of Kuhn's ideas about paradigms and on examples of interactive thinking like Wylie Sypher's *Literature and Technology: The Alien Vision* and essays by Gerald Holton.

Content of *Light and Vision*

The first section of the course begins by treating the nature of myth, specifically the role of the sun in Hebrew, Egyptian, Babylonian, and Amerindian myths. These examples illustrate how mythic thinking unites together in a single text or art work what later cultures treat as separate, even contradicting modes of thought--scientific observation, narrative action, and artistic representation. Placed in contrast to these myths are Greek theories about light, which though hardly empirical rely more heavily and exclusively on observation of the natural world. Yet the "deallegorization" (Holton's term) of Greek science is far from complete; though in *Timaeus* Plato turns for evidence about light and vision mainly to observation of the physical world, in the "Allegory of the Cave" he partakes fully of mythic thought.

Also in Greek ideas students first encounter the significance of philosophical preconceptions as guiding principles to scientific thought. In the contrast between materialistic Atomists and idealizing Pythagroeans we find the specific contrast between intromissive and extromissive explanations for the origin of visual energy. The Atomists, believing that all reality ultimately reduces to atoms in the void, locate the power of seeing in the material world, external to the viewer, while the Pythagoreans, who regard ultimate reality as conceptual, argue that light must originate within the mind and emerge through the eyes, radar-like, to scan the outer world. This section enables us to identify certain enduring themata (Holton again) which are threated through the history of thought about light, and also to note that thanks to the nature of language these original mythical and allegorical modes of conceptualizing light subsequently are never completely purged.

The second section of the course begins with late medieval art, with its flat, non-perspective surfaces (resulting not from technical incompetence but more likely from the medieval Christian belief in the insignificance of the material world) and then examines the transition to Renaissance perspective art. The perfection of the geometry of perspective art is linked not only to Renaissance science and mathematics but also to the increasing secularization of society, the decline of medieval "other-worldliness," and the consequent relocation of ultimate reality in the material world.

Ideas about optics then move from late medieval science and technology to Newton's OPTICKS (1704), which serves to establish the modern scientific method (or myth) of theory derived from experiment, not hypothesis. Newton's work is scrutinized as an exemplar of this method and his vestiges of mythic thinking--the predominance of the number seven, the analogies to music, the fervent religious conclusion--are weighed in the balance. Finally, OPTICKS serves as the starting point for a series of presentations on how non-scientists responded to a major scientific text, with Blake, Keats, Goethe, Turner and the eighteenth-century poets marshalled in M.H. Nicolson's NEWTON DEMAND THE MUSE serving as evidence.

The third series of presentations attempts to parallel three major shifts in more recent concepts of light and vision: from representational art to impressionism, cubism, and OP art; from "common-sense" Newtonian physics to the fractured and more arbitrary physics of Einstein and quantum physics; and from the nineteenth century beginnings of physiology and psychology to the fruition in this century of the contributions of the life sciences to understanding light and vision. Following the observation often noted, we try to suggest the relationship between the breakdown of representational art and Newtonian mechanics in the late nineteenth century, and the simultaneous emergence of cubism and modern physics in the twentieth. Lecturers in physics and the history of science present the importance of Einstein's ideas about light, and the curious centrality in his thought given to the speed of light, while a painter and professor at the Worcester Art Museum examines the new modes of "seeing" in Picasso and Braque, the liberation of form and color from mimetic demands in painters like Albers, and finally the indebtedness of art to modern science in movements like OP and kinetic art. A series of SCIENTIFIC AMERICAN abstracts (from PERCEPTION, ed. Held and Richards) presents the contemporary debate in psychology between empiricists and Gestaltists, in which the mind/matter debate harkens clear back to the opposing ideas of Atomists and Pythagoreans.

Course Organization

The curriculum sketched here is formidable for any undergraduate course, especially when none of the students are in the liberal arts and none may be assumed to have prior backgrounds in the humanities. However, WPI students take only three courses each seven-week term (each course meeting at least four times a week) so that concentrating on fewer activities per term demands more than usual involvement in each course. The "Light and Vision" course employs a format especially useful to its aims: three fifty-minute lectures and one hour-and-fifty-minute conference each week. The three lectures allow sufficient time for conventional presentations of material by a variety of lecturers, while the conference provides an extended weekly opportunity for faculty and students to explore the linkages between material presented piecemeal in the lectures. The faculty teaching the course have tried a variety of approaches to the conference, always using it to get the students thinking about the kinds of connections between different conventional compartments of academic knowledge.

Most recently, the twenty-four students in the course were divided into four groups, with each group responsible for organizing one conference late in the course. Each conference group sought to link together some of the themes which emerged in different ways in the three previous lectures. For example, after faculty presentations of medieval art and technology, Renaissance art and perspective, and Renaissance science and mathematics, the students conducted a conference which covered topics not lectured on such as perspective and projective geometry, Leonardo's contributions to art and science, and the importance of the camera obscura as an artist's tool and as an early mechanical model of the eye. (The other three conferences, at the beginning and end of the course, are faculty-directed introductions and conclusions to the course, and a guided tour through relevant material at the nearby Worcester Art Museum.)

In addition to conference participation, students are evaluated in two hour exams (essay and factual questions) and a final term paper. This final paper (which is the major determinant of the grade) is intended as a mini-project which at its best will present students with the kinds of research problems and modes of analysis demanded in the interactive dgree requirement. Students may use any topic which draws upon technical and non-technical material relevant to the course, and are encouraged to select a topic which may be further developed in either or both the interactive and humanities degree requirements. Examples of recent topics include: impact of modern technology (e.g. holography) on art, optical illusions and art, subliminal perception and advertising, Seurat and science, art and science in Greek or Egyptian architecture, and the geometry of perspective art.

The absence of tailor-made anthologies is always a problem for interdisciplinary courses, and "Light and Vision" is no exception. Consequently we have relied heavily upon reserve material for the reading accompanying lectures. In addition students purchase two useful general books: R.L. Gregory's EYE AND BRAIN and PERCEPTION: MECHANISM AND MODELS, edited by R. Held and W. Richards. Both books, while concerned primarily with the optics and physics of light and vision, contain chapters or essays on art and the history of science. Other useful books, not previously mentioned, are Vasco Ronchi's THE NATURE OF LIGHT, William Homer's SEURAT AND THE SCIENCE OF PAINTING, Gyorgy Kepes's THE NATURE AND ART OF MOTION, John White's THE BIRTH AND REBIRTH OF PICTORIAL SPACE, and Morris Kline's MATHEMATICS IN WESTERN CULTURE.

Conclusion

Student evaluations, and the quality and diversity of topics in the term papers indicate a significant degree of student interest in and enthusiasm for "Light and Vision." Once word got around campus that the course was genuinely interactive, and not in the life sciences as the title might suggest, "Light and Vision" has steadily attracted a clientele of 11 to 24 students each spring since 1974. The faculty of the course--two principal lecturers (one from a technical and the other a non-technical discipline) and three to five guest lecturers--known full well from their experience in the summer of 1973 what kinds of difficulties confront college academics when they attempt to step outside their own fields and scrutinize interactions between significantly different disciplines. We cannot expect constant brilliance from undergraduates when the faculty itself--and indeed what printed research in the area there is--rarely displays a steady illumination. However we have been fortunate in the choice of the topic. No matter how remote from the experience of undergraduate engineering students some of the conceptual links we try to forge may be, the immediacy of daily experiencing light and vision provides the stimulus for continued investigation of the themes of the course.

The course attempts fundamentally not to "cover" a body of material but to help teach a way of thinking about how creativity in and out of science operates; such a conceptual rather than factual orientation always raises major pedagogical problems. But if the undergraduates cannot digest all of the material covered or respond fully to all of the linkages pursued, their term papers usually disclose a significant interest in at least one broad area relating science and/or technology to philosophy or history or the arts. We further stress the integration of different points of view by having faculty lecture on areas of interest outside their disciplines: chemists on myth and art, a mechanical engineer on the history of science, an English professor on physics. Thus, students in "Light and Vision" emerge from the course with more than a history of ideas about light. They have also participated in the challenging attempt of faculty and classmates to go beyond conventional disciplines in order to see how scientists and artists examine light in different but often complementary ways.

--Lance Schachterle, English
Stephen Weininger, Chemistry
John Boyd, Mechanical Engineering
Worcester Polytechnic Institute

Professors Schachterle, Weininger, and Boyd would be particularly eager to hear from anyone who is interested in learning more about this course. You may write to them at their departments, WPI, Worcester, Mass. 01609 -- (617-753-1411). Editor

The following article by Craig Walton of the University of Nevada, Las Vegas, was prompted by his participation in the 1977 USC Humanities Conference. Both Professor Walton and the HPT Newsletter would welcome readers' comments on his thoughts. Editor

BEGINNINGS OF A THEORY OF THE HUMANITIES

The notion of working toward a theory of the humanities involves at least three parts --why do it, what did it mean if it ever did mean anything to our predecessors, and what could it mean today? Briefly, the motivation for doing such a labor today is that virtually all segments and strata of our society agree that our times are undergoing profound stresses from which some significantly different sorts of cultures will be emerging in succeeding generations. Some feel man's best achievements will be soon destroyed or will cease to be regenerated due to massive populations, authoritarian systems and regimented societies to be required as adaptations to new conditions regarding food, water, space and energy. A few others feel hope at the prospect of new forms of social and personal integrity never before seen; most feel uneasy and indecisive, frequently opting for those imminent solutions seemingly helpful to them, such as short-range planning or satisfactions. A theory of the humanities, if well conceived, would by hypothesis seize upon what it is that we now know of man and relate that to the means of possible personal and social maturation so that such a theory would generate action and investigation in every art and science made by man, toward his possible survival and flourishing. It would not merely function as the basis of all other studies done by man, but most crucially would relate to each other the several arts and sciences pertaining to becoming fully human. It would therefore also relate those arts and sciences to all others not dealing with human being, as (in this sense) subordinate (because more particular) arts and sciences. As such, it would serve, not so much as an object to contemplate as a way to develop and liberate the aptitudes of people to cope with the conditions of life toward some feasible global set of relationships between commonwealths. Such a global network implicitly would be limited by the local resources and conditions of life in each case, but if there is a notion of the humanities it would mean that some discernable arts of cultivating needed human capacities for life are generally what they are because of what man is, irrespective of local differences as to expression or interpretation of detail. It may be that only certain soils can grow wheat, but all men are capable of, say, memory, so that there might be a best way to cultivate memory for human purposes. It may be that man will not be able to adapt to the forthcoming planetary conditions of scarcity and space, but such a conclusion cannot be drawn a priori. The issue of a theory of the humanities is only, and not ironically, practical --that is, are there arts or discoverable human capacities for development of natural potentialities by which men can live sanely and peacefully under existing conditions? If so, what are they and how are they discovered and developed? One answer to the 'why do it?' question is that if it can be done at all, it will be most profoundly needed in all future human undertakings just because the arts in question would be prior to and generative of all other abilities to develop or perfect more particular and specialized arts toward human and naturally-required purposes. A second answer is that if the notion being discussed has any meaning at all, it is in reference to arts of human becoming never innate or automatic but also never impossible a priori. Rather, they are by hypothesis possible if developed well and impossible if developed poorly or not at all. Simply, they must be done or they will not be done, and their theory explains why this is the case.

Turning to what the humanities did mean when consciously discussed and undertaken, we might here simply list the studia humanitatis as conceived from ancient Greece to the renaissance, as a review and chronological record. But the modern period has so emphasized division of labor for purposes of intensive inquiries that we would be as Socrates's clown, who turned the needed and single plate into the useless and many pieces of a plate by dropping it --we would "make many out of one" because what began as a search for the *paideia* of people toward maturation and commonwealth would have become the administrative and arbitrary subdivisions of the professions and disciplines presently in place, whether or not anyone thereby becomes anything in particular. This is not to condemm academic departments or professional specializations, but to show that one cannot answer the question at bar by pointing to what are or have been existing social or intellectual subdivisions as a response, however well they may be functioning. Today we seem to assume that since those specializaing activities each go somewhat separate ways, then the undergraduates or the general population will put man, themselves, and society back together again and do it well since each of us in his/her specialty did well his or her part in the story. One original aspect of what we now call the humanities or the liberal arts and sciences, then, was not fields of learning but arts of making a person fully and actively human. The notion of "liberal" might just as well have been rendered as "liberating", in two senses: first, that without *these* arts a person will soon become a creature of unexamined habits, of custom and family or social usage, of unexamined or even locally-reinforced impluses or appetites *irrespective of their truth or their consequences*. But also, secondly, these arts were sought as liberating in the sense that they were seen as letting out, into full play and active life of a self among other selves, of those human capacities needed for achievement of good outcomes but not able to come out if unaided by specific cultivating arts.

In his *Republic*, Plato began the task with *mousikê* --difficult to translate, but perhaps "emotional stability" could suffice: that is, before children can undertake much of a physically-developmental regimen, they can already imagine and appreciate stories in which emotional conflicts, crises and outcomes make up the action and therefore in which one is able to learn which actions should be felt as desireable and which should be felt as harmful. As one's own impulses and emotional responses begin to come forth, they will not pull and tug one at random in all directions but will be felt in some context, in some way which gives orientation of the feeling to some situation and the question of outcomes. Fables, histories, and songs capture children's imaginations but simultaneously instruct them about the world into which they are growing, in a way they can feel before more abstracted or conceptual treatments of the same issues could make any sense to them. If correctly done, these muses' arts both guide and, by their truthfulness, release the children's feelings toward workable outcomes.

Some years after *mousikê* is begun, Plato provides for *gymnastikê* as a parallel art - perhaps translated as physical culture, though reference is not to muscle-building but to learning the proper nutrition and exercise, the ways of eating and playing which develop and then maintain overall physical well-being. Later Plato discusses arithmetic, geometry, astronomy and dialectic, each building on the first two but now cultivating the mind's natural curiosity, to detect those situations where investigation is required or where ignorance is harmful. These activities are meant progressively to build the power to reflect in order that, by way of discursive or what we call ratiocination or calculation - reasoning we may come to be able to intuit, to grasp the whole of something in its complex unity. When we recall that the social stratification in the *Republic* was utilized as a mirror or metaphor to see something else, namely the structure and integration ("justice") of the "parts" of the self, we may at least note that he saw the progression mousikê-gymnastikê-arithmetic-geometry-astronomy-dialectic to be in principle pertinent to all men.

Three observations should be easily warranted: first, the liberal arts or humane studies were supposed to be all and only those needed for anyone to become able to function wholly and actively as a human in society; secondly, they were seen as prior to and irrespective of subsequent particular career studies; and thirdly, they were concerned with developing a good quality of ability to do certain things, which quality was only achieveable through cultivation and then had to be maintained throughout life by use at or above a certain standard. They were needed as habits, based in human nature but not naturally flowering. The artifice of proper cultivation was to be explicitly undertaken. As acquired and maintained they made up one's "second nature" as a civilized person. I stress these three observations because they cut across the 2300 year history of the humanities. Vigorous debate might be needed to reach a working hypothesis today as to which and how many such arts there may be and in what order they are to be nurtured. But that debate would not vitiate these observations --it is not necessary for our present purposes, in a sort of prolegomenon or propadeutic to a possible future theory of the humanities, to commit ourselves in advance to seven or five or three, or to any exact order a priori (or ad verecundiam!). What is necessary is that we consider whether any historical example of such arts was sufficiently well-founded in man's nature to at least suggest to us where to begin critique. The question is partially scientific --what are the most general skills known to be widely needed and also developable under normal circumstances? Nutrition and physical conditioning of the cardiovascular system should immediately receive wide acceptance. Emotional stability may require more discussion, but limiting cases can be clearly set --for example we could but will not teach our children to enjoy intentional harming, or to hate 'playing fair'. I hesitate from further examples just in order to keep the arena of discussion as open as possible; enough has been said here to sketch versions of what the liberal arts or humane studies were once thought to be. Current knowledge and language usage might lead us to locate and describe the needed arts quite differently, without thereby rejecting the project; it need not be seen as a matter of 'going back to Plato' or any of our predecessors in this work. But it is crucially important that we discover why several of the best thinkers in the history of western civilizations gave their contemporaries the versions they did give, and to what extent (if at all) are those versions, once critiqued and reconstructed in our own idiom, useful to us as points of departure for needed discussion and theory-construction. Thus, this section of my remarks is meant only to provoke and focus such discussion.

First, our theory would need to specify which arts are needed, and how each is grounded in what we know of our capacity to become sane and civil. What we now call "moral education" must be involved here, beginning with infancy, but extending throughout adult life and the "passages" involved in its possible flourishing. Second, it would need to bring to light as much or more about the relationships between the liberal arts as about each of those arts considered separately. Our present practice of discussing or studying some quality or quantity of some inherited studies may avoid threatening a prevailing academic territoriality. But such a scattered or "elective" process produces other kinds of crises of authority such as demoralization and cynicism among young and old. That is, if we are in fact doing just about what has to be done and can be done already, and if people feel as "copeless" and beset as so many do, then there cannot be whole and active humans in the present world. But we are not doing well what we do, and we have not undertaken as a public issue of major proportions just what it would be that we ought to do in this regard and why or how to begin to go about it at all. We have willy-nilly pursued a laissez-faire attitude as if some integration and coordination of the soul and the city would therefore emerge, though never the conscious object of anyone's or any community's thoughts and discussions. We need to discuss and bring forward the questions of sequence, relative dependency, and generality of each of the others. Third, therefore, we must not confuse school systems or theory of education with our present problem, for two reasons: (a) many of those arts children acquire will come to them outside of formal school systems, e.g. in home, media or community; and (b) the more complex arts of human becoming cannot be developed until adolescent and adult life. It is not possible to develop one institution, such as what we now call "educational" institutions, to nurture all the needed arts in question, irrespective of home, worship, work, and community. Moreover, we increasingly suspect that vital human transitions and hence arts of living sanely together may have to be studied and cultivated up until the time of death. Surely we are not likely to sustain much longer the belief that the needed arts could be acquired in one's minority and then, at twenty-one, be sufficiently mature and intact as to require thenceforth only normal upkeep and maintenance. Plato suggested that the paideia of the philosopher-king, and by implication then of any person insofar as his noetic capacities are concerned, could not begin until age thirty; Aristotle set the same age for those wanting to begin the study of human practice. Whatever we think of their views, our theory must at least consider that human maturation may not only require certain liberal arts basic to all particular achievement, but may require some of them only in middle, or only in later life, or others to be revised and adapted as one's being changes. Fourth and finally, such a theory would have to make clear its own relationship to theories of the several and particular arts and sciences safely treated as departmentalized disciplines. That is, our theory must make plain how it differs in kind from a theory whose subject matter might either be learned or ignored as the individual chooses or as his talents may incline him. A theory of the humanities would pertain to all people prior to and irrespective of which careers or special aptitudes they might have. By its very definition our theory could not be optional to anyone, or balanced on a par basis in competition with some other theory. For the same reasons our theory could not assume some one institutional embodiment or social manifestation, but rather would underlie and generate sequences and varieties of institutions regarding various aspects of its scope. It would underlie and inform the courts, legislation, commerce, schools, family, worship, recreation, media, and medicine.

One final note: we frequently encounter a sharp "theory vs. practice" distinction, by which it is commonly believed that practice is fragmentary or chaotic in some relevant way and theory is unitary or abstract such as to make it inherently unlike the situations to which it presumes to apply in the humanities. This objection is most vocal regarding our present concern for humane studies or the liberal arts - as if to say that a theory would be the same as a prescriptive rule system violating individual freedom of practice and the uniqueness of each self. Briefly, the objection is founded in ignorance due to confusion. A theory of the humanities would no more threaten individual freedom than a theory of metabolism would prevent one from eating what he "wants". A theory of the humanities would investigate, bring to light, and display in their complex unity those arts needed by people for the whole and active functioning of their being in the world and in history. To the extent that the theory was true to what man is and how he can develop, knowledge of it would liberate and enable him to grow well, rather than hinder his growth or understanding of action. Because those arts are inherently practices of a certain kind, their theory is precisely about that kind of practice rather than some subject-matter lacking in or not rooted in any consequences (if, indeed, there are any such theories).

--Craig Walton
Department of Philosophy
University of Nevada/
LasVegas

Health PAC/cpf

◇ TECHNOLOGY AND THE THEORY OF THE HUMANITIES ◇

Discussions following from a 1977 conference on "Toward a Theory of the Humanities" raise a number of issues about the dilemmas of the humanities, the problem of theory, and the relation of these problems to concrete issues in science, technology, and social change. The purpose of this article is to provide in short compass our thoughts on the place of theory in the humanities and the relevance of theoretical understanding both for a reconstruction of the humanities and for a more humanistic social practice with regard to science and technology. This presentation immediately raises the questions of why the humanities require reconstruction and what forms enlightened social practices might take.

THE ANTI-THEORETICAL BIAS OF THE HUMANITIES

It is with good reason that many humanists define themselves in other than theoretical terms. To accept the requirements of theoretical discourse appears to entail modes of rationalist thought which are commonly associated with the development of the sciences, hence antithetical to the humanistic enterprise. This anti-theoretical bias has manifested itself in opposition to abstract notions, even like "human sciences." Its thrust is toward an emphasis on human performance in essentially unique situations. The difficulty of this approach is that it leads to an abstractness of its own, a romantic isolation which leaves the humanities without a center and without connection to other forms of human endeavor. The existence of this problem requires taking up the problem of theory in a way which avoids its rationalistic and scientistic entanglements.

PROBLEM OF THEORY AND THE HUMANITIES

The goal of theory is the achievement of order, clarity, and coherence beyond mere appearance. There can, of course, be great disagreements about the kinds, forms, and degrees of order claimed in various theories. But in the elucidation of connections and foundations of appearances, there is the process of forming and in-forming the world. In the establishment of regularities, commonalities, and patterns of significance, masses of cases and examples are organized and shaped; warnings are provided; and questions are raised.

Such a treatment of the nature of theory illuminates the character of form, content, and process in theorizing which are covered over in more empiricist and accumulationist notions of theory, which accompany the usual notions of science. This perspective shows that the problems of understanding and engagement are common to both the sciences and the humanities and suggests that a more profound orientation toward processes of thought and criticism are necessary. This realization, in turn, suggests a conception of the humanities which is missed in many versions of humanistic activity, and to which we shall return.

A distinction is necessary here between theory in the humanities and theory of the humanities. There are a number of theories in the humanities, such as those of texts, interpretation, history, etc. It is arguable that these are sufficiently articulated as theoretical perspectives or that the issues among competing theories are sufficiently addressed. However, in the traditions of humanistic discourse, these theories are logically unavoidable, and humanists weaken their insights by ignoring the theoretical contexts and issues in their work. However, our concern in this paper is in theory of the humanities, a set of foundational ideas about the nature and activities of the humanities which can be used to inform specific problems, such as our ambivalences about science and technology.

TOWARD A THEORY OF THE HUMANITIES

Developing a theory of the humanities requires some sense of the structural relationships between various forms of human being and the conditions and undertakings which define them. This is obviously a major task which far exceeds the limits of a short article. Nevertheless, we wish to sketch one possible set of relationships which may serve to illustrate the sorts of issues which must be dealt with if the foundations of the humanities are to be theoretically clarified.

Three forms of human being appear central: analysis, expression, and relation. We can orient ourselves toward the world analytically as we do in science, expressively as in artistic performance, and relationally as we do in our dealings socially with others. However, we need to recognize that there is no one-to-one correspondence between these forms and existing disciplines or object domains (for theory). Science, for example, is a community of relations and a form of expression as well as a mode of analysis. Similarly, we establish relations not only with other persons but with nature and ourselves. Forms of pure expression, such as the way in which art is typically understood, can also be illuminated by forms of analytic understanding as well as by patterns of relation.

Each of these forms presuppose an understanding of what it is to be human in the sense that they address the ambiguities of conditions and undertakings. In the absence of such an understanding--more properly, self understanding--a natural science of society and human experience would be sufficient. It is in the engagement of individuals and groups with both their conditions and the understanding of their conditions through analysis, expression, and relation which makes action and thought logically possible. Being human therefore, as the fundamental subject of the humanities, involves the critical self-conscious representation of conditions and possibilities. It is the story of how human beings can, do, or might deal with the perplexities of their experience. As we have suggested above, a theoretical approach to this undertaking is essential insofar as human beings attempt to establish order, identity, and direction in their lives. Our manifest inability to do this completely suggests that the theoretical enterprise must be a continual process of examination, reflection, and reformulation.

The notorious lack of progress in humanistic study derives in part from the non-cumulative character of critical inquiry but it also derives from the humanists' own unwillingness or inability to challenge and explore the relationship between their own work and the human setting from which it derives.

SCIENCE, TECHNOLOGY, AND THE HUMANITIES

For the most part, humanistic scholars have reacted to the rapid development of science and technology, their implications for society, and the widespread concern for humanistic attention to these conditions by a combination of romantic rejection, "adding on" of value considerations to a calculus of technical decision-making, and generalized complaint. The approach to theory of the humanities developed here, using the forms of analysis, expression, and relation mentioned above, enables a different and more direct involvement by the humanities with the problems of science and technology. The approach of the humanities, we argue, implies a focus on the grounds of actions and conditions rather than on consequences per se. It implies attention to the cultural context in which science and technology have developed, the religious and philosophical presuppositions underlying them, and the aesthetics of relationships in a technologized world. As such, theory of the humanities concerns itself with the specifically human conditions and paradoxes associated with understanding and with decisions, but it is not necessarily directly concerned with immediate policy involvement, as in technology assessment, environmental analysis, or social impact studies. Such theory necessarily relies upon criticism to articulate possibilities as they are realized and lost in social processes and human understanding. Critique is thus the appropriate mode of inquiry in the humanities. But such critique must be more than the negative, destructive dialectic of complaint and rejection with which we are all familiar. It must be oriented toward the illumination of pivotal transformation points in the history of traditions. It must concern itself with both successes and failures in the response to options and constraints. But most importantly, it should illuminate human possibilities, both as they were realized and covered over in historic situations and as they can be drawn out in our attention to contemporary experiences. Thus, in the application of the theory of the humanities there is a dialectic of criticism and creativity, of recognizing limitations and making new proposals. The second half of this dialectic now seems virtually non-existent in the humanities except insofar as we understand creativity as the subjective and arbitrary activity of performers. Theory of the humanities can give substance and content to the situational constraints and visionary alternatives which appear in human performance. The focus on critique alone does not inform the processes of design in which we all can and do engage. As such, it does not connect means and ends, conditions and possibilities, freedom and constraint which make us humans and therefore not subjects of science or technology as ordinarily understood.

In these terms, the theory of the humanities applies to science and technology not as the mere rejection of machines or knowledge, but as the analysis of how combined processes of evolution and design have led to specific powers and entrapments. It opens the discussion to possibilities for human organization, relations to nature, and relations to one another which are both conceptually and politically liberating. It forces attention to questions and assumptions which, as the basis of our culture and civilization, do not often get asked, and are not easily answerable. The central question is that of the human appropriation of science and technology, including the dilemmas raised by human fallibility and the sometimes excessive desire for familiarity, organization, and continuity. For example, there are assumptions about human well-being, improvement, and appropriate power relations implicit in both our social and conceptual treatments of machines and tools. There are judgments about aesthetics and religion implicit in our Western concerns for domination, control, and artifice.

The reluctance of humanists to become involved in apparently mundane problems, like those of the cultural foundations of science and technology, lead to scholasticism and a technicism in the humanities themselves. Without focus and location for their work other than those provided by the internal questions in particular disciplines, humanists eventually have only their own group to speak to. Their historical perspective is overly narrow and their learning unavailable to the illumination of on-going human possibilities.

On the other hand, if humanists participate in public and policy discussions only as additional "technical advisors," their contributions are equally distorted. Rather, they can help to illuminate the assumptions, the origins, and the structure of debates which tend to become technocratic. They can achieve this critique by pointing out the myths and metaphors which define our worlds, including views about the place of our own subjectivity within these worlds. What they must help us to see is the ways language works in talk and writing. Theory of the humanities is in this sense theory of language. But if this theory is to be anything more than (scientific) description and typology, it still must illuminate, as we have suggested, the grounds of human experience and possibilities, even as they are necessarily limited by our conceptions of them.

The promise of the theory of the humanities, then, is to restore the human dimension of individual and social undertakings to the mainstream of intellectual and practical concerns. Suggestions for the realization of this promise would lead to many questions and many literatures, some of them outside the realm of most humanists' attention, such as political-economic analysis and social policy proposals. The primary concern is about orientation, self-reference, self-constitution, and communication rather than subject matter per se. (And of course there are important questions about the limits of particular styles or forms of communication.) Specifically in terms of the humanistic treatment of science and technology, there are aspects of both scientific and institutional practices which require discussion in terms of power and ideology.

Our purpose in this short article has not been to provide a laundry list of topics or issues with which humanists might address science and technology issues, for even this has a technical ring to it. Rather we have tried to suggest what is fundamentally at stake in human activities, hence in the perspectives which humanists might bring to them.

--Dudley J. Burton,
Environmental Planning
and
Jan D. Dekema,
Research Associate in Humanities
University of California--
Santa Cruz

RETHINKING THE VALUE OF TECHNOLOGY TRANSFER

Denis Goulet. The Uncertain Promise. New York: IDOC/North America, Inc., 1977, pp. xiv, 320, Paper, $5.95.

In recent years, much attention in international commercial relations has been given by the less developed countries (LDCs) to the effort of gaining competitive parity in the world industrial marketplace with the developed countries (DCs). The primary objective in this endeavor has become bridging the ever-widening standard-of-living gap between the rich nations and the poor nations. To accomplish this end, a panacea of sorts has received widespread publicity, namely, that through intensive application of technology transfer from the DCs to the LDCs, a firm industrial base can be laid which will serve as the mainspring for developing suitable economic infrastructures in the "have-not" nations. To be sure, at first blush this plan appears to have laudable intentions; but, nevertheless, several serious political, economic, social, and cultural considerations still remain as stubborn obstacles. Consequently, Denis Goulet has undertaken this study to clarify the multifacited nuances of these problem areas; in so doing, he has stripped away that veneer of mystique which surrounds modern technology and has revealed technology's dualism as both a simultaneous purveyor and destroyer of human values.

The Uncertain Promise concentrates upon the disparity in goal-values that stem from technology transfers between DCs and LDCs, with case studies principally drawn from Latin America. At the outset, Goulet facilitates the reader's ability to grasp the essence of the technology conundrum by supplying useful definitions of his operational concepts. "Technology," according to the author, should be perceived as "the systematic application of collective human rationality to the solution of problems by asserting control over nature and over human processes of all kinds" (p. 6). "Transfers" are seen as "the circulation of know-how across national boundaries," and "values" assume the form of "attitudes, preferences, styles of life, normative frameworks, symbolic universes, belief systems, and networks of meaning which human beings give to life" (p. 6, emphasis in original). These definitions, though admittedly broad and generalized, do allow for substantial flexibility of conceptualization. "Technology transfer" as an act is not merely shipping hard capital goods (i.e., machinery) to an LDC; it further involves the exchange of intellectual skills, as well as the practical ability to apply knowledge. Similarly, the notion of "value" presupposes intrinsic material worth, but even more importantly, it also inculcates far-reaching normative implications.

Respective to economic development per se, Goulet contends that technology looms critical for four chief reasons: 1) it is a resource, and relatedly, a creator of new resources; 2) it entails a potent instrument of social control; 3) it can have decisive impacts upon positive decision-making; and 4) on a more sociological plane, technology can proffer new meanings for life by countering alienation. The conclusion implied here seemingly is obvious, but profound: Modern technology's introduction into any society can have both positive and negative ramifications vis-a-vis the human values of that society. In other words, while technology surely permits new degrees of social freedom from the constraints imposed by nature, tradition, or social mores, it also carries with it new determinisms and responsibilities for those livelihoods upon which it impinges.

Goulet argues convincingly that the force of modern technology, given its high sophistication and pervasiveness, has evolved into an "exploitative Prometheanism" -- a "God Technology" -- which is now squarely challenging the normative roots that undergird the fundamental values of traditional societies. Further, technology has engendered a dynamism which has produced rapid social change, a process which today is operating to alter man's appreciation for Nature as a part of his societal environment. If Goulet is correct here, the upshot of this radical transformation is distinctly paradoxical: In prehistoric ages, man was dominated by nature; yet, through ingenuity, he created technology as a tool for overcoming this domination. In time, however, technological application has become so all encompassing that it currently threatens to overwhelm mankind and subvert the very norms of humanistic values to a deus ex machina.

Although Goulet is primarily concerned with diagnosing the problem of those conflicting cultural values emanating from technology transfer between DCs and LDCs, he is also mindful of the need for solutions. As a result, he advocates a number of requisite policy prescriptions, among them the establishment of national technology infrastructures; the correlation of developmental priorities with appropriate technologies; the negotiation of coherent transfer strategies; the realization of "two way technology flows"; and the fostering of international commitment to technology support programs. These actions, taken together, will realistically enhance the possibility for successfully adapting technology to less developed regions of the international economic order. Finally, as the author rightly posits, institutional actors (e.g., national governments, transnational enterprises, and international agencies) will have to serve in concert as stewards of this global economic transition.

On balance, The Uncertain Promise presents a humanistic perspective of the sociocultural costs which likely will be extracted, if international economic development is to be facilitated through technology transfer. Value conflicts in this process, Goulet maintains, inevitably will persist, but as he later points out, "many Third World leaders resignedly now accept the destruction of their own cultures in order to gain modernity" (p. 250). Given this situation, one is tempted to ask whether "progress" is worth this price, or whether "bigger and faster" is necessarily "better". Yet, the issue is not so simple, and as the author concludes, the key lies in what specific criteria are designated to determine those values which will be destroyed and those which will be preserved. That decision ultimately must fall to the people themselves, and to their relative wants and aspirations as set against their realistic needs and capabilities.

In summary, then, technology transfer in and of itself will not be able to cure all the ills of underdevelopment. It can, however, assist in alleviating them, albeit by sacrificing an uncertain amount of cultural values. This is the prospect posed by Goulet's pensive volume, a prospect, the repercussions of which, will not be felt fully until such a commitment to technocracy has been decidely made throughout a society. Thus, science and technology, despite all their noteworthy contributions in the past for bettering humankind's socio-economic condition, remain encumbered by at least one major flaw: the inability to make perfect man's normative relationship with his fellow man. In the final analysis, this is the most salient message gleaned from The Uncertain Promise.

--Christopher C. Joyner
Dept. of Political Science
Muhlenberg College

People's Platform/cpf

Tom Chalkley
Environmental Action

A NEW INTRODUCTORY TEXT

Technology, Change and Society by Edward C. Pytlik, Donald P. Lauda, and David L. Johnson (Worcester, Mass.: Davis Publications Inc., 1978) deserves consideration as a basic text in introductory level Science, Technology and Society type courses. The authors of this book "about technology and its impact on society," view technology as "a primary determinant of social change" which is "altering human lifestyle to its existential roots." They move from the definition of technology to the assessment of technology in 283 pages divided into thirteen chapters, and the length and logical arrangement mark the book as especially tailored for a one semester course.

This book is certainly and clearly basic and introductory. The authors summarize and synthesize existing material, rather than adding new interpretations or insights of their own. They approach technology in a fair and balanced way, presenting positive and negative sides of issues. The prose is simple, spare, and down-to-earth, though sometimes pedestrian ("The traditional religious belief most seriously questioned by modern technology is the belief in God."). The organization is schematic, so that students find virtually all the information in crisp units and in numbered, outline fashion ("The direct impact of technology on politics can be seen from two sides," "Four basic patterns of educational curriculum structuring are apparent in modern societies," "Two factors associated with modern technology appear to threaten the continued existence of the family"). All of these things mean that the text is easy to read, easy to understand, easy to study from. Since the book is general and introductory, however, most teachers will probably supplement it with in-depth lectures and other books.

Part I begins with a definition of technology before moving in "Technology and Human Life" to a consideration of technological determinism and the need for human choice through summaries of such thinkers as Ellul, Teilhard de Chardin, McLuhan, and Mesthene. In "Technology and Society" technological change is exemplified by a look at the family, politics, education, economic systems, and religion. The section on the family, for instance, stresses the impact of industrialization and contraception, while the section on politics stresses both the managerial and participatory aspects. The human case against technology is boiled down to the four points of conformity, alienation, rootlessness, and disenchantment in "Technology and the Individual," and biological modification, Skinner's technology of behavior, and Ferkiss's Technological Man are considered as alternatives. In the last three chapters of Part I technology itself is divided into low, intermediate, and high (rather than a long and involved history of technology), technological societies are divided into tribal, emerging, and post-industrial, and the concept of technology transfer is introduced. In the last two chapters eleven clear and concise point by point case study comparisons provide hard factual information (comparisons, for instance, of the Tasadays, India, and Japan).

Part II, which is almost exactly one-half of the book, focuses on specific issues that threaten our existence --population, energy, ecology, medicine, and work-- before ending with "The Search for Alternatives," technology assessment and forecasting. The chapter on "Population Growth and Its Demand on Global Resources," for instance, is chock full of statistics, and moves from the case for and against population controls, to population trends, demands on food production, research on insecticides, case studies from Mexico and the Phillipines, ending with urban sprawl and water pollution. The chapter on "The Ecological Question" contains a graphic description of a pollution control device, and the chapter on medicine considers the moral problems surrounding organ transplant technology. The chapter on work contrasts assembly line problems with such alternatives as the Volvo experiment, and suggests the vital need to prepare for the leisure society.

No book which aims at such breadth is going to please everybody, but this book looks to me like a solid skeleton for general, introductory courses in the Science, Technology and Society field.

--Edward J. Gallagher
Department of English
Lehigh University

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BENDER, BERT A. "LET THERE BE (ELECTRIC) LIGHT! THE IMAGE OF ELECTRICITY IN AMERICAN WRITING." ARIZONA QUARTERLY 34 (1): 55-70, SPRING 1978.

Although appropriated by American technology, electricity still remains an inexplicable phenomenon. American writers, having sensed the "metaphysical" possibilities of electric power, have seized electricity as a medium to express conflict--between the machine and the garden, within the divided self, between culture and the individual. Bender surveys the use of such imagery from the qualified wonder of Edwards, Franklin, and Whitman, to the skepticism of Hawthorne and Melville, on to the sense of horror, and darkness evident in Fitzgerald and Hemingway. Finally, the role of electricity in Ellison's Invisible Man sums up its use in our literature. In his quest for light, the invisible man finds "a dark knowledge of himself and of his culture's power structure."

BUTTEL, FREDERICK H. AND WILLIAM L. FLINN. "SOCIAL CLASS AND MASS ENVIRONMENTAL BELIEFS, A RECONSIDATION." ENVIRONMENT AND BEHAVIOR 10 (3): 433-50, SEPTEMBER 1978.

Based on a statewide survey of Wisconsin residents conducted in 1974, the authors find that previous research which has equated environmental concern with upper-middle class status may be in error. Their results indicate that the effects of education, income, and occupation on environmental attitudes are meagre. Instead, age and place of residence are better predictors. Working class concerns about the environment have hitherto been considered insignificant; the present survey indicates that pro-environmental attitudes are strong in younger generations and city dwellers.

"CONSIDERATIONS IN THE REGULATION OF BIOLOGICAL RESEARCH." UNIVERSITY OF PENNSYLVANIA LAW REVIEW 126 (6): 1420-46, JUNE 1978.

The legal issues surrounding the regulation of potentially hazardous biological research are explored. Considerations discussed include who should control such research, the constitutional implications of regulation of research, the efficacy and limitations of existing control statutes such as the Toxic Substances Control Act and the Public Health Services Act, the development of an administrative agency composed of scientists and laymen. The drafting of legislation to create a regulatory commission with preemptive powers over local control is proposed. Extensive documentation.

DUNCAN, OTIS DUDLEY, "SOCIOLOGISTS SHOULD RECONSIDER NUCLEAR ENERGY." SOCIAL FORCES 57 (1): 1-22, SEPTEMBER 1978.

During the late 40's and early 50's, sociologists who considered such matters forecasted, with little dissent, an age of atomic abundance, in which electricity would be as free-flowing as water. For two decades interest in the energy field was dormant, only to be reawakened by the almost unforeseen growth of a public antinuclear movement. It is time, Duncan suggests, for sociologists to recapture their research corner from technical experts. The nuclear controversy has demonstrated that many problems initially defined as technical and scientific are eventually recognized to be social and political.

FISCHHOFF, BARUCH; SLOVIC, PAUL; LICHTENSTEIN, SARAH; READ, STEPHEN; COMBS, BARBARA. "HOW SAFE IS SAFE ENOUGH? A PSYCHOMETRIC STUDY OF ATTITUDES TOWARD TECHNOLOGICAL RISKS AND BENEFITS." POLICY SCIENCES 9 (2): 127-152, APRIL 1978.

The public acceptance of risk taking as a necessary sacrifice for adequate power has been a frequent topic in recent social science literature. Chauncey Starr's "revealed preferences method" has yielded a set of laws directly relating acceptable risk to perceived benefits. Psychometric procedures used by the present author elicited judgments about perceived and acceptable risks and perceived benefits for a number of innovations and activities. Unlike Starr, however, Fischhoff and co. found no evidence for "laws."

GILBERT, JAMES B. WORK WITHOUT SALVATION: AMERICA'S INTELLECTUALS AND INDUSTRIAL ALIENATION, 1880-1910. BALTIMORE: JOHN HOPKINS UNIVERSITY PRESS, 1977. XV + 240 P., ILLUS.

Gilbert investigates the intellectual reactions to the problems of alienated work, individualism, and splintered community at the turn of the century. In particular, the thought of William James reflected the difficulty society had in grappling with the idea of a work ethic which no longer explained or satisfied American society.

KASSON, JOHN F. AMUSING THE MILLION; CONEY ISLAND AT THE TURN OF THE CENTURY. NEW YORK: HILL AND WANG, 1978. 120 P., ILLUS., PHOTOS.

Coney Island's history dramatizes the effects of the rise of urban-industrial civilization on the American masses. Kasson presents an insightful exploration of the illumination Coney's heyday casts on the cultural upheaval during the early decades of this century. Through a synthesis of histories of the resort, early magazine accounts, studies of crowd psychology and New York City lifestyles, Kasson reveals how the entertainment developed at Coney reflected the lives of the urban millions. Assisted by many photographs, the author discusses the responses of the entrepreneurs who developed Steeplechase, Luna, and Dreamland parks.

LIPSEY, MARK W. "ADAPTATION AND THE TECHNOLOGICAL SOCIETY: A VALUE CONTEXT FOR TECHNOLOGY ASSESSMENT." ZYGON 13 (1): 2-18, MARCH 1978.

If one accepts the optimistic view that man can still regulate technological development, then it becomes necessary to address two tasks: 1) the determination of the range and nature of technological effects on life and 2) the elaboration of a values framkework yielding standards by which technological consequences may be evaluated. Adopting an adaptational view of human behavior, Lipsey identifies four domains in which humans are vulnerable to technological disruption: adaption (physical), competence, adaptability (cultural) and impressionability (receptivity to change).

MILLER, SANFORD A. "THE KINETICS OF DIET AND CULTURE." TECHNOLOGY REVIEW 80 (8): 38-45, AUGUST/SEPTEMBER 1978.

With the aid of technology, man has overcome technical barriers to producing enough food for the world's population. What have proved recalcitrant, Miller feels, are cultural patterns of food consumption and production. The cultural function of food is far greater than mere sustenance; for example, in industrialized and developing societies alike, an increased intake of animal protein and calories has become a status symbol accompanying development, even at the expense of good nutrition.

O'MALLEY, BECKY. "MICKEY SAY, MICKEY DO." NEW TIMES 11 (8): 40-57, OCTOBER 16, 1978.

Among the drawing cards for Disney World has been its remoteness from teeming Miami reality and the technologically achieved comforting "thematic" wholeness emanating from humble wastebaskets and treelike trailer hookups to Disney lodgings and transporation. With sardonic wit and a good deal of documentation, O'Malley looks at a real-life "theme park"- the Reedy Creek Improvement District. Ostensibly just another local government district, the RCID is in fact almost entirely composed of acreage owned by the Disney corporation. The imagineers, O'Malley charges, have engineered a feudal principality in which public monies are used to pave roads and build sewers for private interests.

RODGERS, DANIEL T. THE WORK ETHIC IN INDUSTRIAL AMERICA, 1850-1920. CHICAGO: UNIVERSITY OF CHICAGO PRESS, 1974. XV + 300 P.

Traditional values of work were shaken by evolving industrial forms. As a result, many people questioned the factory system and the direction of progress. Rodgers discusses the manner in which work values changed by examining the ethic's origins and its expression in debates over wages, creativity, leisure, feminism, children's literature, and political rhetoric. Good intellectual history. Valuable footnotes.

VANEK, JOANN. "HOUSEHOLD TECHNOLOGY AND SOCIAL STATUS: RISING LIVING STANDARDS AND STATUS AND RESIDENTIAL DIFFERENCES IN HOUSEWORK." TECHNOLOGY AND CULTURE 19 (3): 361-375, 1978.

With mass production and urbanization came a trend toward more equal distribution of goods and an easing of social stratification based on purchases among housewives. Standardization of household goods and practices accompanied the replacement of servants by appliances and electricity, also an egalitarian trend. As reinforcement for new values, the media preached standards for cleanliness and nutrition. Not household consumption, Vanek argues, but education and employment became status markers for women.

VARELA, JACOBO, A. "SOLVING HUMAN PROBLEMS WITH HUMAN SCIENCE." HUMAN NATURE 1 (10): 84-90, OCTOBER 1978.

Trained in the know how tradition of engineering, Varela came to social sciences eager to solve, rather than study, social problems. He believes that the "social technology" needed to cure many ills is already available in the findings of decades of social research. In this article, several case studies of work accomplished by Varela's students are presented.

WEIGEL, RUSSELL AND JOAN. "ENVIRONMENTAL CONCERN: THE DEVELOPMENT OF A MEASURE." ENVIRONMENT AND BEHAVIOR 10 (1): 3-15, MARCH 1978.

Reports results of investigations of reliability and validity of the Environmental Concern Scale, a test to measure attitudinal concern about the environment, change in public attitudes, impact of environmental policies and legislation. Scale's validity is well documented, and implementation is simple.

--Judith Mistichelli
--Christine Roysdon
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ANNOUNCING

ALTERNATIVE FUTURES

--The Journal of Utopian Studies--

Alternative Futures provides a forum for utopian and futures-oriented scholarship and commentary.

Alternative Futures features material from the entire range of disciplines bearing on utopian and futures thinking: philosophy, history and literature on the one hand and ecology, sociology, political science and values aspects of science and technology on the other.

Alternative Futures was conceived in order to bring the utopian thinking of the present into confrontation with utopian aspirations of the past, and to assess the ways in which hopes or fears for the future have always shaped, and continue to shape, present action.

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Merritt Abrash
Co-Editor, Alternative Futures
Human Dimensions Center
Rensselaer Polytechnic Institute
Troy, New York 12181

Alexandra Aldridge
Co-Editor, Alternative Futures
102 Rackham Building
University of Michigan
Ann Arbor, Michigan 48109

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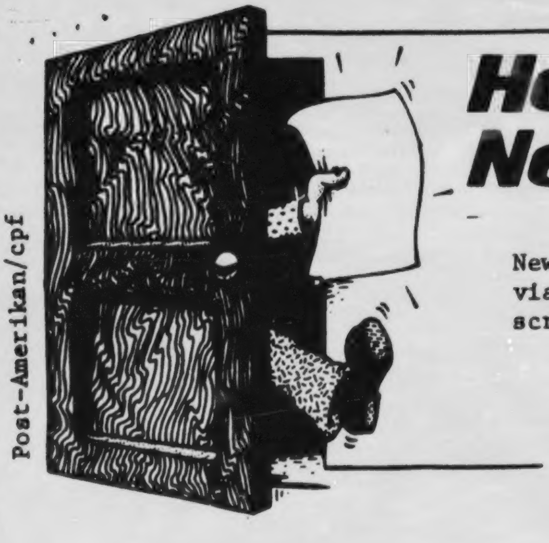

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Hot News

The HPT Curriculum Development Newsletter recently received additional support from the National Endowment for the Humanities to continue publication on a free basis for an interim period. During this period we will be polling you as readers to determine your ongoing interests and directions for the Newsletter. We will also be seeking your response to the viability of continuing the Newsletter for a nominal subscription fee at the end of this period.

We would like to express our sincere thanks to the NEH for their support, but more importantly we want to thank you our readers. Your many and varied responses, written and oral, were a major contributing factor in establishing the success of the Newsletter and the desirability of extending its life. Hopefully your continued interest will make the Newsletter even better.

We would like to extend a call for:

- Short articles (1,500 - 2,000 words) on theoretical and speculative aspects of curriculum development.
- Concise introductions to classic figures and themes in the STS field.
- Detailed course descriptions.
- Reviews of texts and audio-visual aids.
- Course syllabi and other items of curricular interest.
- Descriptions of extra-curricular programming.

Have any of you made specific use of techniques or texts referred to in previous articles? If so, what has been the result? We would like to know.

Again, a final note of thanks for your support and for the many Newsletter contributions we have received in the last year and a half. Please keep the communications flowing.

Dr. Stephen H. Cutcliffe
Editor

* * * * * * *

A CLONE'S CLONE

Graced with my widow's peak and wandering eye,

Hobbled by my bunched thigh muscles

And arms fragile as Bernardt's bustles,

Stand my carbon paper person and I.

With nails to chew and moles to pick,

Pacified is the angst of a brain that's ill

(Or transferred to some liberated Jill,

Through Everhard, the many-mowing dick.)

Narcissus meet Narcissus (without the usual fall)

Loving the xerox like the shadow,

Writing together a clone-novel at Yaddo,

Enjoying our life in Versailles's Hall.

Death we'll share too, in brain, balls and bone.

So home to the lab, sweet clone: we're only on loan.

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Jack De Bellis

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WORKSHOPS ON ETHICAL ISSUES IN ENGINEERING

a two week institute for philosophy and engineering educators, will be presented by the Center for the Study of Ethics in the Professions, Illinois Institute of Technology, Chicago, July 16 to 27, 1979. These NSF-NEH supported workshops are designed to provide educators the materials and interchange of ideas needed for courses on ethics and professional responsibility of engineers. Subject matter and cases will concern the situation of the professional, ethical problems confronting engineers, strategies for resolution of problems, and roles and responsibilities of engineering societies, government, and the individual. Staff for the workshops includes philosophy and engineering faculty of Illinois Institute of Technology and distinguished visiting lecturers in various disciplines. Participants will receive travel funds and a stipend. For further details and application forms write:

Dr. Vivian Weil
Center for the Study of Ethics in the Professions
Illinois Institute of Technology
Chicago, Illinois 60616

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HUMANITIES PERSPECTIVES ON TECHNOLOGY

Curriculum Newsletter of the Lehigh University HPT Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 10
February 1979

ASKING THE HARD QUESTIONS

A new course which examines social concerns and human values in an engineering context

During his visit Spring Quarter of 1978 to the University of Washington, Professor René Dubos, microbiologist and Pulitzer Prize winning author, addressed the effects of technological change on our cultural and natural environment. On each issue--nuclear power, solar energy, DNA research-- Professor Dubos argued that the scientific part of the problem was far less puzzling to solve than the human one. The centralization required to run nuclear power plants poses, he believes, a much greater threat to an open society such as ours than even nuclear accident or waste disposal. Quoting fellow scientist, Alan Weinberg, former director of the Oakridge National Laboratory, Dubos stated, "How to make technology adapt to the needs of human beings--that's the hard question."

A new course offered by the Engineering College was developed to deal specifically with this many-faceted problem: "Technological Risk--Deciding What's Acceptable." Co-taught by Gene Woodruff, Professor of Nuclear Engineering, and Mary Coney, Lecturer in Humanistic-Social Studies, the course was experimental in two ways: (1) to see whether people's reactions to risks created by modern technology could be studied as an academic subject; (2) and whether teachers coming from much different educational backgrounds (nuclear engineering and English literature) could together present a coherent course of educational value and intellectual rigor. "We were," Professor Woodruff says, "taking a risk ourselves, but one we thought necessary and challenging--for students and ourselves."

The basic objective was not to assess the dangers of various technological advances. Such studies are already well underway and in some cases, at least as far as the experts are concerned, the answers well understood. Rather, the class was to investigate the murky area of human reaction to modern risk--why we find, for example, the widespread and well documented dangers associated with coal mining somehow less frightening than newer energy sources, especially nuclear power whose peacetime dangers are more potential than proved.

The following "hard" questions dictated the boundaries of the course: What is the nature of modern risk? How does it differ from our pre-industrial dangers? What are the factors that can and should influence individual reactions to risk? What are the methods by which the public can evaluate and decide collective risk?

Obviously, these issues span many disciplines and, at least at present, claim no experts. To reflect accurately the interdisciplinary character of risk acceptance, Coney and Woodruff called on a variety of speakers to contribute their particular insights. Their common response was at once enthusiastic (for the subject matter) and reluctant (about their ability to say something definitive).

This lack of "expertise" turned out to be one of the remarkable and productive characteristics of the course: for one thing, it accurately reflected the "state of the knowledge" about risk acceptability. In intellectual exploration, certainty has no place. And secondly, each speaker's humility and a sense of excitement radiated to the students. Unlike the more traditionally defined courses where the class and the lecturer are separated by a gulf of knowledge and the students are expected to do all the learning, these weekly two-hour sessions became a truly joint venture--with faculty listening and learning alongside the students.

Since the beginning of the class coincided with Professor Dubos' visit to the campus (not a complete coincidence!), he agreed to lead off the expedition with some speculation about man's basic nature and how that affects any study of risk perception. As a biologist, Dubos argued that, "Risk is a peculiarly human phenomenon. In fact, we must take risks to be human." Comparing the lion who, no matter how powerful, accepts his environmental prison to primitive man who alone of all species chose to move out of the environment that shaped and protected him, Dubos concluded that man's value system accounts for his willingness to put himself in danger. And thus we need to become clear about our values--as individuals, as a culture, and as a species--if we hope to develop some valid measurement of risk acceptability.

Intrinsic to Dubos' position is a belief in man as a free agent, affected by his environment but capable of adapting it to his own purposes. While most of the speakers that followed worked from this same assumption, Professor Robert Kohlenberg of the UW Psychology Department characterized man as a creature whose behavior is determined by positive and negative reinforcements. Man will accept, for example, a risk because that act has in his past "paid off." Conversely, what he values as important in life is insignificant as a motivating factor. Even the act of evaluating risks and benefits is a reinforced behavior all by itself. (Obviously the students and faculty involved in the course shared a positive experience of evaluation and were simply seeking a repetition of that pleasure.)

Johan Facht, visiting economist from Sweden, outlined how risk is considered in economic analysis. Using the model of man as a rational being, Facht differed from Dubos by seeing man as basically a risk averter. "How else to explain," he asked, "why people consistently pay more money for insurance than risks prove out?" But the lack of consistency both in costs of estimating risks and in perceptions of what is risky plagues the insurance industry. Furthermore, there is no present market mechanism to measure environmental quality or quality of life. "Decision making must," Facht concluded, "occur at societal levels given the limits of economic methods." What a society will tolerate depends on a much more complex set of factors than the monetary system.

Two researchers from Battelle Human Affairs Research Center, Dr. John Hebert and Dr. Barbara Melber, underscored the complexity of assessing public attitudes about risk. In their study of social issues dealing with energy technologies and environmental practices, a number of conflicts emerge: between the expert and the non-expert, the objective evidence and the subjective response, the individual and collective mind, voluntary and involuntary risks. In summary, those who decide the risk and those who take the risk and those who receive the benefits are rarely the same people. How to adjudicate the claims of each group becomes the key to a safe and democratic society. Melber, a sociologist, expressed her belief in the political process as the fairest means to compromise various conflicting values.

But even that process is fraught with difficulties. Two class participants,

Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

Gordon Orians, zoologist and Director of the Institute for Environmental Studies at the University, and Professor Kai Lee, political scientist who is also associated with the Institute, spoke on their wide experiences working in Washington, D. C. with regulatory agencies that oversee, interpret, and attempt to protect the public's interest. Even the experts, Orians found, are beset with yet unsolved problems caused by inadequacy of evidence. Two kinds of errors are typically made: Type I, seeing an effect where there is not one; Type II, seeing no effect when there is one. "We are spending far too much time on Type I whereas Type II presents the greatest potential danger to our society," Orians asserted. But part of the difficulty comes from the differences among the various risks the agencies are required to evaluate. Short term acute risks are easiest to assess and easiest to reverse. The Pinto gas tank problem will, it is safe to say, be solved completely in ten years. At the other end of the scale are those long term chronic risks that we barely perceive much less know how to mitigate. Microwaves present in our environment, coming mainly from radar, televisions, and ovens, present an incredible challenge to the skills of governmental regulation. One is tempted to add metaphysical prophecy to the requirements for a risk assessment.

An additional complication noted by Professor Lee in his year as White House Fellow was that risk decisions were usually made as a by-product of other decisions, and in some cases not even understood as such or acknowledged. Our oil impact policy is largely determined by other than risk assessment factors, yet the associated dangers to our health are profound. However successful we become in our institutional arrangements for risk, the burden for decision must fall on all of us, especially those most affected. "Institutions do not make judgments," Lee reminded us. "There is finally no substitute for morality."

To give the students a chance to test the theories that were beginning to emerge, Woodruff and Coney chose two particular case studies, nuclear power and recombinant DNA, for presentation. Woodruff took the former and drew from his own first hand experience as a nuclear engineer working with the public to find the proper combination of energy options. As an expert himself, Woodruff is particularly aware of the immense influence professionals can exert and how that power can be abused. Because some experts unfortunately tend to put their ambitions above public interest, a code of ethics needs to be developed. Woodruff recommended especially two rules:

(1) The expert must be scrupulously honest about the status of the facts he is presenting. He must distinguish carefully among those that are proved, those that most experts believe, and those that only he believes.

(2) When the question shifts from a scientific one of risk assessment to the humanistic one of risk acceptability, the expert should disclaim his expertise and speak only as a citizen.

The efficacy of these standards was reinforced by Professor Bereano of Social Management of Technology who serves on the University Committee to oversee recombinant DNA research. Unlike Woodruff, Bereano spoke of his role as a layman, albeit an informed one, who makes crucial policy about a highly complicated and controversial subject. The first problem, of course, for a layman in this position is to become informed enough so as to interact effectively with scientists. Next, he must be aware of the possible disparity between guidelines established and guidelines followed. It is too easy, Bereano found, for labs to become careless as the procedures become familiar. In fact, familiarity and accident pose a dual threat to safe laboratory practice--both being human rather than scientific errors. He urged the students not to back away from participating in risk assessment. No one, including the specialist, ever knows enough. To borrow a phrase from history, our safety is too important to be left to the experts.

Out of the diversity of the presentations, several factors began to appear which influence man's perception and acceptance of risk: familiarity (if it is a danger we are used to); time (how quickly a risk is thrust upon us); scale (the magnitude and complexity of a new technology); the media (where most people get their information, but where bad news gets more attention than good); the intensity of opposition; the obviousness of the benefits; and finally, choice (man needs at least the illusion of control to feel secure).

How these factors can be used is another question and one the class could not answer. The temptation to assign each some quantity and develop a formula for predicting public reaction is a strong one: decisions could be rendered in a more timely, orderly fashion. And as distasteful as such formulations might appear to humanists, they do offer a basis for rationality so badly needed in the political arena.

The class did agree on the insufficiency of any one discipline or methodology in determining what risks a society will or should accept. In the final lecture, Dr. Coney cited man's imagination as one of his most valuable and accurate tools for risk evaluation. "That power, unique to the human species and possessed by each member, can," she argued, "assure that our choices suit our needs and safeguard our future."

Begun as an experiment, the course ended with a feeling of accomplishment among faculty and students alike. Although the special exicitement in breaking new ground will be difficult to repeat, Woodruff and Coney have decided to offer the course again next Spring. New students, new speakers, and more hard questions promise a fresh treatment of an age-old problem.

--Dr. Mary B. Coney
Department of Humanistic-
Social Studies
College of Engineering
University of Washington
Seattle, Washington

* * * * * *

THE ENGLISH TEACHER MEETS THE TECHNOLOGICAL CLASSROOM

It started pragmatically enough. The title was "Choosing Futures: An Introduction to Futurology." Its objectives were, stated in well-behaved form, these "The Student Wills":

- Develop awareness of the impact of present decisions and actions on the future;
- Study the literature of futurology;
- See the correlation between futurology and science fiction;
- Extrapolate the future in limited areas;
- Extrapolate personal futures;
- Analyze personal attitudes toward change;
- Write an extrapolative essay;
- Learn the tools of predicting the future.

Its texts were listed as:

Earth in Transit, ed. Sheila Schwartz

The Futurologists, ed. Alvin Toffler

Small is Beautiful, E. F. Schumacher

On the neatly-typed blue dittoed handout there was a list of assignments noting when filmstrips were to be shown, games played, reports due, quizzes taken --even which pages were to be discussed in which three hour class period during the one month interim period. Also included were some hints on how to do reports. In a small college, where students know all about the entire faculty within a week of unpacking, everyone knows the reputation of a teacher who invents precise syllabi alterable by death alone.

Small schools also are known for restricted courses. This interim short course had been passed by the Educational Policies and Curriculum Committee, partly because of my impassioned arguments regarding the need for future studies and my declarations of membership in the World Future Society and the South Dakota Futurists, and partly because I was secretary of the committee.

After the usual panic about having any one at all sign up for the course; there were seventeen in the class. Five are required to meet; twenty is the maximum. The accumulated students were not a normal English class in any way. My (sorry about the favoritism) best senior English major was there, and a young woman who had started college nine years before and was finishing in English and Psychology while running a downtown bar. A brother and sister, bright but very reserved, were considering majoring in English. Then there was the captain of our football team, a junior who had just learned that he had been dropped from the teacher education program, a freshman who had failed all four courses first semester and was being given a last chance, the projectionist from a local move theatre (a biology major), and several whom I had never seen. Three of these were men working in the local 3M plant, which encourages further education. Actually, most of them had never seen each other --quite a feat in a school of slightly over 500.

Students were notified clearly of the basis of their grades: 1. Regular attendance is required: unexcused absences will lower grades one letter per two misses; 2. Three reading reports--25%. Complete reports merit A's, but must be in on time and meet the standards given; 3. One group project--25%; 4. One individual extrapolative essay--25%; and 5. The average of 3 quizzes--25% (70% is passing).

When I started out the first day, I had an exact idea of what I would be doing every day of the interim. My first lesson plan read:

1. Take roll
2. Do questionnaire on attitudes toward change
3. Compile and discuss results
4. Introduce the syllabus, explain grading system and standards
5. Introduce the filmstrip
6. Show "From the Odyssey"
7. Discuss suggested questions, reasons for sf
8. Show "The Cult"
9. Discuss questions given in teacher's guide
10. Define utopia and dystopia
11. Assign readings: after reading the first section of Earth in Transit, list qualities of utopia present or not present.

The three hours passed in an orderly fashion. The filmstrip series, Encounters with Tomorrow, was a strong basis for the factual presentation and had a great emotional impact because it is so striking in its visuals and so forceful in its musical score. What I did not realize was that the first day set up the momentum that carried me and the class far from the neat syllabus rapidly toward alternative ways of meeting the objectives.

My second day's lesson plan was equally neat. As I look at it now, it is still orderly and numbered. We listed the qualities of an ideal society, saw another of the filmstrip series, and discussed the stories in Earth in Transit. The third day's plans show signs of disarray, crossed-out activities. I had asked them about the project each one was to do. Sf music was suggested; interviews with people whose fields were changing; man on the street interviews; civil defense. All the students, locked up together for almost nine class hours by now, admired the others' ideas. During the ten minute breaks, they started to form coalitions.

The next couple days were enjoyably passed in the best English class form, discussing the really good stories and viewing the rest of the filmstrips. We played "Futuribles," created by George E. Koehler and distributed by the United Methodist Church's Board of Disciples. This is a decision-making game, full of thought-provoking cards which the holder evaluates and priorities. Students loved the many ways of playing the game, and we repeated it later in the month. Just at that time our town, Mitchell, South Dakota, had a public hearing and referendum on a low rent housing project for senior citizens. There was some violence and much malice in the community. In terms of utopian thought, the local students brought up the matter, dramatizing the threats and costs of change.

When we got into the Toffler book, we took some time from the demanding readings to play "Future Decisions: the I.Q. Game," created by Betty Barclay Franks and distributed by SAGA Publications. This is an excellent simulation activity, a new experience for the students --and for me.

Now, by this time, the students had had enough small group discussions that they knew each other pretty well. I had dutifully lectured and provided charts of methods of futurologists, including synectics, systems analysis, and change strategies I had learned not from my precise graduate school training, but through the American Association of University Women and my experience as part-time trouble-maker. We watched a video-taped Nova presentation on future medicine and the special, "Land of Hype and Glory," one of my friends had taped for his psychology of advertising class. We listened to an interview of Isaac Asimov (Science Fiction: The Early Days) and some spacey sf-type music I had been collecting for years.

Meanwhile, during the breaks, the coalition built.

"Can we do one group project instead of several?" they asked. I thought that was fine. They had realized the force of all that media I had been using to fill three hours usefully. They had observed the impact of games and everyday life on their willingness to consider what might happen. The ultimate push toward the class's taking over and cutting my syllabus to shreds was very simple and untechnological. I got a cold. What's more --I lost my voice.

The class came over to my house and looked over all my Futurists, Education Tomrrows, personal books, scraps from magazines and papers, and Smithsonians; and while they listened to the Moody Blues and drank coffee, they devised the great plan.

With the help of our media director (we used to call them librarians) who is also an sf freak, they went to work on all the machines DWU has. They learned to make slides from pictures; they examined the existing slides, tapes, records, and books; they discovered materials the librarians did not know we had; they hunted down professors with expertise in science, economics, and education; they found students who were National Farmers Organization members and thinkers; they discovered that two Minneapolis aeronautics experts were in town and corraled them for an interview; they talked the civil defense director away from his office on to campus; they learned to use catalogues to order free films. Before long the library was full of students, directed by the two senior members of the class, busily taping, filming, photographing, reading, and phoning.

I worked on syllabi for the second semester.

Actually, I adjusted lenses, found some hidden resources, and occasionally was of some value. I did calm down an angry professor whose interviewer was late. Our media director smiled and smiled and gave advice. We were all very happy.

The final project was aired four days into the second semester. All the class, including parents, friends, brothers, and faculty members, showed up for a three hour multi-media presentation which had been painstakingly edited from the taped interviews. The sound track was in stereo 8-Track. From slides, interviews, film clips, records, and original writing, they put together a project which I --course designer and futurologist-- had no idea would come about. We had learned to use educational technology and student power. One librarian decided I was teaching an audio-visual course. I was not teaching anything. The class was teaching itself, and I was one of them. Several of my colleagues told me that they had never seen a class work so hard.

Yes, the class was very kind to their structured teacher. They all turned in their reports, passed their quizzes, and wrote extrapolations that they enjoyed enough to read to each other between taping interviews. The course did exactly what it was designed to do.

If the colleage courses of the future are to be anything like the one of January 1978, I can endure several more years of complaints about the state of modern education. Meanwhile, I definitely will continue to work with educational technology.

Mary S. Weinkauf
Professor of English
Dakota Wesleyan University
Mitchell, South Dakota

Technology in History

History 136

Prof. Ruth Cowan
Dept. of History
SUNY at Stony Brook,NY

This course uses a series of historical case studies, arranged in roughly chronological order, to illustrate the various relationships between technological change and social change. The course is intended for students who have very little historical background, but over the years some history majors have taken it and found that it also adds a dimension to their understanding of history.

The textbook for the course is Melvin Kranzberg and Carroll Pursell, Technology in Western Civilization, volume I. Five short quizzes are given during the term on the five separate sections of this text. A research paper is also required for the course. Students are asked to choose a technological change of particular interest to them and to attempt a retrospective technology assessment. Students are asked to focus specifically on the social impact of the technological change. The textbook (both volumes), Charles Singer, A History of Technology (all volumes) and Eugene Ferguson, A Bibliography of the History of Technology are the basic resources from which students are asked to prepare bibliographies for their papers; a preliminary bibliography is required in order to assure that on any given topic the student will have access to reliable and pertinent information.

The following is a list of the case studies that are covered during the term; this list is supplemented by references to some of the sources of information and analysis.

Medieval Technology: The Demographic Impact of Changing Agricultural Techniques and the Structural Impact of Changing Forms of Warfare.
Lynn White, Medieval Technology and Social Change
Jean Gimpel, The Medieval Machine

The Invention of Printing with Moveable Type: The Complex Nature of Invention; Transference of the Means of Production; Impact on Ideas and Attitudes in the Late Renaissance.
Elizabeth Eisenstein, The Impact of Printing

Science and Technology in the Scientific Revolution: Huyghens and the Pendulum Clock; Relations between Modern Science and Technology; Differing Norm Systems and Class Origins of Scientists and "Engineers."
Carlo Cipolla, Clocks and Modern Culture
R. K. Merton, Science and Technology in the Seventeenth Century

Pre-Industrial Forms of Work: Familial, Patriarchal, and Time Variable Work Patterns in Agriculture, Guilds, Domestic System.
Peter Laslett, The World We Have Lost

Post-Industrial Forms of Work: The Factory as Social Control; Formation of New Classes.
Neil Smelser, Social Change in the Industrial Revolution
Anthony Wallace, Rockdale
E.P.L. Thompson, The Making of the English Working Class
Harry Braverman, Labor and Monopoly Capital

The American System of Manufacture: Social and Economic Factors Governing Rates and Types of Technological Change.
H. J. Habbakkuk, *British and American Technology in the Nineteenth Century*
Merritt Roe Smith, *The Harper's Ferry Arsenal*

Municipal Water Supplies: Creation of Governmental Institutions with New Functions as Response to Technological Change.
Joel Tarr, F. C. McMichael, "The evolution of wastewater technology and the development of state regulation," in Joel Tarr, ed., *Retrospective Technology Assessment*

Rudolf Diesel: Relations Between Inventors and Entrepreneurs; Social Choice in the Exploitation of New Technologies.
W. Robert Nitske and Charles Morrow Wilson, *Rudolf Diesel*

Household Technology: Technological Potential Nullified by Social Conditions.
Ruth S. Cowan, "The Industrial Revolution in the Home; Household Technology and Social Change in the 20th Century," *Technology and Culture*, 17 (January 1976)

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Men and Machines in American History

History 376

Prof. Bruce Sinclair
Dept. of History
University of Toronto

This course will be treated as a seminar, meeting once a week, on Tuesday from 4 to 6 p.m. In addition to assigned reading on specific topics under discussion in the seminar, the following paperbacks will be used extensively:

Brooke Hindle, *Technology in Early America*
John A. Kouwenhoven, *The Arts in Modern American Civilization*
E. T. Layton, *Technology and Social Change in America*
E. E. Morison, *Men, Machines, and Modern Times*
C. W. Pursell, *Readings in Technology and American Life*
Nathan Rosenberg, *Technology and American Economic Development*

Each member of the seminar will be responsible for conducting one meeting in the Fall term and one meeting in the Spring term. Those two assignments, together with your weekly participation in the seminar, will make up 50 percent of the course work. The other 50 percent will be based on a research paper. All topics must be selected in consultation with the instructor prior to the Christmas recess. An outline of the paper, which indicates in some detail (203 pages) what you think are the interesting issues of your topic and how you plan to investigate them, together with a critical bibliography, will be due on January 13. The finished paper will be due on March 30.

Seminar Topics

Fall Term

Sept. 16 - Introduction

Sept. 23 - Historiography and Bibliography

Sept. 30 - Settling the Frontier

Oct. 7 - The American Revolution and the Industrial Revolution

Oct. 14 - The Transfer of Technology

Oct. 21 - Canals and Railroads

Oct. 28 - The Patent Office

Nov. 4 - Technology and Democracy in the Jacksonian Era

Nov. 11 - The Mechanics' Institute Movement

Nov. 18 - Sources of Power

Nov. 25 - The American System of Manufactures

Dec. 2 - The Industrial Exhibitions

Dec. 9 - The Mechanization of Agriculture

Spring Term

Jan. 6 - Technical Education

Jan. 13 - Engineering as a Profession

Jan. 20 - Scientific Management

Jan. 27 - Conservation and Efficiency

Feb. 3 - Technology and the City

Feb. 10 - Edison and the Electrical Age

Feb. 17 - Reading Week

Feb. 24 - New Technologies for Transportation

Mar. 2 - New Technologies for Communication

Mar. 9 - World War I

Mar. 16 - Industrial Research

Mar. 23 - World War II

Mar. 30 - The Military Industrial Complex

Apr. 6 - Limits to Growth and the Whole Earth Catalogue

SCIENCE FICTION FOR THE STS TEACHER

STS teachers on my campus and elsewhere frequently ask me to recommend science fiction on a specific subject. Sometimes they are just curious about what science fiction will do with a specific matter, but more often they are looking for a work to include in a course, to assign as outside reading, or to recommend for reference purposes. Here are a few of the works I usually recommend to help them find what they need.

Bernard C. Hollister and Deane C. Thompsons' Grokking the Future: Science Ficion in the Classroom (Dayton, Ohio: Pflaum/Standard, 1973) is aimed at high school teachers, but it is useful to the "alien" at any level looking for a story on a topic of social relevance. The book has ten easy-to-read chapters about science fiction works on ecology, population, the machine, the automobile, atomic power, social control, prejudice, economics, cities, and the generation gap. Each chapter suggests the range of topics or issues which specific stories relate to. The chapter on the machine, for example, mentions about twenty stories under such headings as the price of progress, the advent of automation, the human computer, a threat to democracy, the inhumanity of machines, dependence on machines, and the apocalypse. Suzanne Millies' Science Fiction Primer For Teachers (Dayton, Ohio: Pflaum, 1975) contains lists of stories (with very brief annotations) under eight headings. The "Man and Science" heading, for instance, lists about fifty stories under such sub-categories as fantastic inventions, mind control, man and robot, the mad scientist, and warnings.

Thomas D. Clareson's Many Futures, Many Worlds: Theme and Form in Science Fiction (Kent State University Press, 1977) contains three helpful, overview essays on topics regarding which many STS teachers are interested. Focusing on the work of Kurt Vonnegut, Kendall Foster Crossen, and Ira Levin, but placing them in a context that goes back to Samuel Butler's Erewhon (1872), Carolyn Rhodes' "Tyranny by Computer: Automated Data Processing and Oppressive Government in Science Fiction" (pp. 66-93) discusses science fiction warnings since the 1950s about computerized record keeping and decision making. In "Virgin Territory: The Bonds and Boundaries of Women in Science Fiction" (pp. 140-62), Beverly Friend divides her subject into women as gadgets, women as objects, and such speculative future societies as female worlds and androgynous worlds. Patricia Warrick's "Images of the Man-Machine Intelligence Relationship in Science Fiction" (pp. 182-223), starting as far back as Frankenstein, divides man-machine science fiction into two categories: the extrapolative, which is usually set on this Earth in the near future, aims at social criticism, focuses on shortcomings in the present world, and is thus mainly negative; and the speculative, which is usually set in the far future, in which all manner of man-machine relationships are conceived, and which tends to show creative symbiosis rather than conflict.

There are, of course, science fiction anthologies on virtually every subject, but let me just mention two --both by Pamela Sargent-- which have the overview introduction densely packed with the kind of specific references that can be useful to the STS teacher. Sargent mentions about thirty-five stories in the introduction to Bio-Futures: Science Fiction Stories About Biological Metamorphosis (New York: Vintage, 1976), and shows that science fiction moves from a consideration of "individual cases and accidents to a view of the future in which biological change is normal and creative." In the long introduction to Women of Wonder: Science Fiction Stories By Women About Women (New York: Vintage, 1975) Sargent states that most science fiction is still "primarily escapist adventure, saturated with male-oriented power fantasies," but that "only sf and fantasy literature can show us women in entirely new or strange surroundings."

If you are interested in experimenting with science fiction in your courses and do not have time to wade in and randomly read around in the field, these five works may help point you in the right direction. They provide descriptions and contexts which should enable you to choose your samples wisely.

--Edward J. Gallagher
Dept. of English
Lehigh University

UTOPIANS, SCIENTISTS AND ALTERNATIVE FUTURES:

A JOURNAL REVIEW

Alternative Futures: The Journal of Utopian Studies, ed. by Merritt Abrash and Alexandra Aldridge; published quarterly (Spring, Summer, Autumn, Winter); sponsored by the Human Dimensions Center, Rensselaer Polytechnic Institute in cooperation with the University of Michigan Rackham Graduate School and the Humanities Department, College of Engineering.

In recent years the study of the future has achieved academic salience, if not intellectual credibility. The presses are pouring forth increasing numbers of futures-oriented studies, while undergraduate and even graduate courses on the future are fast appearing on college curricula everywhere. In the traditional competition between "humanistic" and "scientific" approaches to knowledge, it would seem that the scientists are setting the pace in futures studies. The Club of Rome projections, MIT computer simulations, Hudson Institute scenarios --all rely heavily on the application of supposedly scientific techniques to the analysis of present trends and their extrapolation into the future. The humanists, armed with little more than paper and pen, seem to have been routed decisively, and reduced to impotence on the sidelines of the academic rush to the future.

Although many battles have been lost by the humanists, the war is by no means over. On the contrary, there has been a regrouping amongst the humanists, and the recent appearance of this new journal is perhaps the first salvo of their new offensive. Alternative Futures: The Journal of Utopian Studies, is the brainchild of (amongst others) Merritt Abrash of Rensselaer Polytechnic Institute and Alexandra Aldridge of the University of Michigan. Its purpose, according to the co-editors, is to publish articles on "utopian literature and thought, communitarianism and social experiment, utopian/dystopian science fiction, and futures inquiry which is non-technical in nature." Well and good, but with "futures inquiry" tacked on at the end of this list, why is the journal titled Alternative Futures? One suspects that the editors are trying to regenerate interest in utopian studies (which have become very unfashionable in recent decades) by jumping on the current futures studies bandwagon. This is perhaps so, but it would be unfair to dismiss the journal as a Johnny-come-lately in the larger futures enterprise; rather, we should welcome it as a vital new contribution to a field that is rapidly becoming dominated by narrow technological approaches.

Indeed, in one of the early issues of the journal, Warren Wagar quotes Bertrand de Jouvenal on the intimate linkage between utopianism and futures studies:

> Man is fortunate when the desirable and the probable coincide! The case is often otherwise, and thus we find ourselves trying to bend the course of events in a way which will bring the probable closer to the desirable. And this is the real reason why we study the future.

I personally find this argument persuasive, and it is for this reason that I welcome the appearance of this new journal. As the quotation suggests, however, we seem to be embarking on a highly subjective and normative exercise, for we are "trying to bend the course of events" in ways consonant with our individual perceptions of desirable futures. Is this really the task of "objective scholarship" in today's quest for understanding in a complex and rapidly changing world? Surely, we would be better advised to examine current trends and extrapolate future possibilities based on a dispassionate, scientific analysis of the "facts and figures" of the real world? Still, as David Ingersoll and Daniel Rich argue in their article on "The One-Dimensional Future," it is simply impossible to separate the normative from the seemingly objective in the study of the future. Whether it be based on the computerized studies of the Club of Rome or the personal visions of Buckminster Fuller, they argue, "futurological knowledge is...intended to serve as a basis for action, however vaguely the association of knowledge and action is specified."

If this is so (and I doubt that many would argue the point), why not admit it at the outset and bring new dimensions to the study of the future. Why not, for example, open our minds to the consciously subjective and speculative world of utopian and dystopian literature? The narrow, one-dimensional approach of the scientific quantifiers will be thereby enriched by the intellectual and creative power of the utopian, communitarian and science fiction traditions. It is by no means suggested that the utopians and their kindred spirits should instruct scientific students of the future as to the answers they should find; rather, their fertile minds could help the scientists to formulate the right kinds of questions to ask. Often, the value of a field of academic inquiry is determined not by adroitness of methodology or surety of findings, but by the intellectual vitality engendered by posing the kinds of questions that spark human curiosity and creativity.

Despite some intellectual bravado, Alternative Futures in essence is making a plea for peaceful coexistence in the continuing battle between the scientific and humanistic traditions in thinking about the future. It recognizes the indisputable role that scientific approaches to futures studies do and should play in the common enterprise, but it is trying to stake a claim for the relevance of normative, non-technical approaches as well. Doubtless, the editors will be hard pressed to establish a viable balance between offering a forum for the systematic study of non-technical approaches, and becoming an impassioned spokesman for a particular school of thought and/or action. Both types of journals would have valuable contributions to make, but at the present stage the role of honest broker of utopian, communitarian and science fiction approaches to futures studies seems to be the most appropriate.

In this regard, I should point out that the journal is hoping to serve as a clearinghouse for the non-technical aspects of futures studies. In addition to its solicitation of original articles, it also provides opportunities for contributors to make short "observations" on issues of concern, and it reviews a few current books in the field as well. Of special interest is the "News Center," which provides quarterly surveys of new monographs and periodical literature, recent and planned conferences and seminars, new developments in the field, and other relevant material. This will provide an invaluable service for those of us who are not really a part of the field, but wish to keep abreast of what is going on.

Based on a glance at the first two issues (Spring, Summer 1978), it would seem that most of the contributors are from the humanities (English, philosophy) and the social sciences (political science, psychology). There is a stray practitioner of electrical and computer engineering, but the natural scientists are distinguished by their absence. Given the nature of the journal, this is perhaps as it should be, but one suspects that greater efforts should be made to entice the humanistly-minded natural scientist onto the pages of the journal. Hopefully, this will become evident in future issues, for it will give the journal a greater degree of credibility within the opposite (and sometimes hostile) intellectual camp.

All in all, Alternative Futures is an interesting and highly promising entrant into the continuing debate over scientific and humanistic approaches to futures studies. If there are any disgruntled humanists who wish to strike a blow for an "imagined" future rather than one that is "programmed," they now have a weapon in their hands. Is the pen mightier than the computer? We shall see.

--Ray Wylie
Department of
International Relations
Lehigh University

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BOORSTIN, DANIEL J. THE REPUBLIC OF TECHNOLOGY: REFLECTIONS ON OUR FUTURE COMMUNITY. N.Y., HARPER & ROW, 1978. XV + 105p.

Boorstin presents brief explanations of America's relationship with technology in seven somewhat unconnected essays, most of which have been previously published. The book is offered in the belief that the converging powers of technology have reduced differences among the nations of the world and that America, the "Republic of Technology," has had and will continue to serve a central role. Specific topics include political technology and the Constitution, the machine, immigration, and education. Also see META annotation Issue No. 5, April 1978, p. 17.

CLARK, JOHN R. "THE MACHINE PREVAILS: A MODERN TECHNOLOGICAL THEME." JOURNAL OF POPULAR CULTURE 12 (SUMMER 1978): 118-26.

The modern spirit, as expressed in literature of this century, voices an uneasiness, distrust, fear of technology. Early dystopias where the machine overtakes civilization (Forster, Capek, Rice, O'Neill) are followed by comedy in the 1930s (Thurber, E.B. White, Coover). But after the Bomb, the image of the machine becomes more ferocious and prevalent. In works by Vonnegut, Pynchon, Barth, and Clarke, the machine becomes the superior intellect which controls. Mechanical apparatus is only the obvious focus of fear. This literature reveals that man really trembles over the ambiguities and delusions of the human inventors.

DORF, RICHARD C. AND YVONNE L. HUNTER, EDS. APPROPRIATE VISIONS: TECHNOLOGY, THE ENVIRONMENT, AND THE INDIVIDUAL. SAN FRANCISCO: BOYD & FRASER, 1978. XV + 351p.,ILLUS., FIGRS.,TABLES.

A collection of apropriate technology-oriented essays, most of which were presented at the "Small is Beautiful" conference held in February 1977 at the end of E. F. Schumacher's U.S. tour just prior to his death. Besides Schumacher, who was a major force at the Conference, other contributors include Richard C. Dorf, Yvonne Hunter, Garnett Hardin, Tom Bender, Sim Van der Ryn, and Herman Koenig. In addition, there is a lengthy article by Barry Commoner entitled, "Freedom and the Ecological Imperative: Beyond the Poverty of Power."

ENCYCLOPEDIA OF BIOETHICS. EDITED BY WARREN T. REICH. NEW YORK: THE FREE PRESS, 1978. 4 VOLS.

The 300 articles in this 2000 page work discuss the issues, concepts, and principles related to biomedical ethics. Articles are arranged alphabetically from "Abortion" to "ZygoteBanking" and each includes an extensive bibliography. Contributors represent the following fields: biomedical sciences, philosophical ethics, health professions, religion, law, anthropology, sociology, psychology.

ENERGY AND THE ENVIRONMENT. ISSUE TITLE. AMERICAN BEHAVIORAL SCIENTIST. 22 (NOVEMBER/DECEMBER 1978): 173-320.

The six papers in this issue approach the energy-environment relationship from a public policy perspective. An article by James L. Regins follows the rise of energy and the environment as public issues. Erik J. Strenehjem and Edward H. Allen study socioeconomic and institutional constraints on the development of new energy resources. Lettie and Manfred Wenner assess the roles of public participation in energy policy formulation. A final paper by Helen Ingram suggests that states should be given a larger role in energy policy development.

FOWLES, JIB. "THE IMPROBABILITY OF SPACE COLONIES." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE. 12(DECEMBER 1978): 365-78.

The prospect of space colonies, as proposed by Gerard O'Neill has caught the attention of increasing numbers of people. Fowles argues that the dreamof liberation from earth's woes offered by proponents of such colonies is a false one. Evidence continues to mount that long-term space voyages are dangerous physically, given even the best of artificial environments. With disaster always threatening, life in a space colony would be eternally disciplines and mechanized. Economically and ecologically, space colony development might also be unsound, consuming more resources than it can ever return. Fowles concludes, "Space is a desolate, oppressive place that offers little to human beings except confinement and regimentation."

GELLA, ALEKSANDER: JENSEN, SUE CURRY, AND SABO, DONALD F., JR. HUMANISM IN SOCIOLOGY: ITS HISTORICAL ROOTS AND CONTEMPORARY PROBLEMS. WASHINGTON, D. C.: UNIVERSITY PRESS OF AMERICA, INC., 1978. XIII, 250P.

Placing humanistic sociology in an embattled position among positivism and behaviorism, or "scientism," the authors attempt to promote their subdiscipline. Opening with an historical review, the book then turns to humanistic sociology's potential for alleviating problems of man in technological society through stimulating concern for morals and values. There is an appendix, "Humanistic Trends in Recent Sociology: A Guide to Literature."

HENDERSON, HAZEL. "SCIENCE AND TECHNOLOGY: THE REVOLUTION FROM HARDWARE TO SOFTWARE." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 12 (DECEMBER 1978): 317-324.

Though it will be sometime before the earth's physical resources are exhausted, society has already reached its conceptual limits to growth. Industrial society has entered an entropy state in which "the technological process has generated such scale, complexity and interlinkage that it has become unmodelable, and hence unmanageable." A reconceptualization of the metaphysical premises of industrialization is needed, Henderson believes. Major belief systems based on rationalism, reductionism, and continual expansion must give way to a holistic, balanced world view.

LIU, BEN-CHIEH. "TECHNOLOGICAL CHANGE AND ENVIRONMENTAL QUALITY: A PRELIMINARY SURVEY OF ENVIRONMENTAL INDICATORS IN MEDIUM METROPOLITAN AREAS." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 12 (DECEMBER 1978): 325-336.

A mathematical model is developed which measures environmental quality of life in 83 medium-size standard metropolitan statistical areas. The model is composed of such environmental indicators as air, water, visual, noise, and solid waste pollution; temperature; sun days; inversion frequency; recreational facilities. Explanation of mathematical formula and the ratings of the SMSAs are provided. Pacific region cities are generally highest ranked (Tacoma is best). Surprises include an outstanding rating for Trenton while Tulsa is lowest; South Atlantic cities are substandard. All cities, even the highest and lowest ranked, have problems and pluses.

MANN, ROBERT W. "TECHNOLOGY FOR HUMAN REHABILITATION." *TECHNOLOGY REVIEW* 81 (NOVEMBER 1978): 44-53.

The application of technology to the problems of the handicapped is a recent development long overdue. New devices described include: the optacon (a portable device for the blind); the pathsounder, also for the blind; and prosthetic devices, including the Boston and Utah Arms and the Swedish Hand.

PETULLA, JOSEPH M. *AMERICAN ENVIRONMENTAL HISTORY: THE EXPLOITATION AND CONSERVATION OF NATURAL RESOURCES*. SAN FRANCISCO: BOYD AND FRASER, 1977. 399P., ILLUS., FIGS., MAPS, BIBLIOG.

A new textbook on environmental history based primarily on standard secondary source material which surveys the American scene from the first colonists through the early conservation movement to today's ecological concerns. Each major section --the Colonial Period, the New Nation, After the Civil War, and the Twentieth Century-- is preceded by a chronology of important events, while individual chapters are followed by references for further reading. Useful for those desirous of a basic introduction to the field.

PHOTOGRAPHY. MASSACHUSETTS REVIEW 19 (WINTER 1978): 630-892.

The current debate between proponents of photography as a "detached, symbolic, and formalistic art" and those who consider the photographer as a medium between the objective world and particular visions of it is the premise of this issue. Considerations of the implications of the debate are joined with many full-page black and white photographs. Among the articles are: "The Romantic Machine: Towards a Definition of Humanism in Photography," by Bill Jay; "Camera Work: Notes Toward an Investigation," by Alan Trachtenberg: Allan Sekula's "Dismantling Modernism, Reinventing Documentary;" "In Our Image," by Wright Morris; and a statement by Walker Evans. There are studies of the photography of Aaron Siskind, Steiglitz, Hine, John Szarkowski, Helen Levitt.

SEGAL, HOWARD P. "AMERICAN VISIONS OF TECHNOLOGICAL UTOPIA, 1883-1933." *MARKHAM REVIEW* 7 (SUMMER 1978): 65-76.

Twenty-five fictional and non-fictional technological utopias appearing in this fifty year period provide "full-scale blueprints" of ideal societies, including physical appearance, institutions, inhabitants, and values. Included are works by engineers and industrialists. Societies "run by and for technology" emphasize efficiency, order, self-control, cleanliness, and harmony. Technology and Nature are "domesticated." Transportation and communication systems are usually described in detail as are the values of technocracy. By imitating the machine man finds fulfillment. Extensive documentation includes a listing of technological utopians and their writings.

SIMON, ROGER, ED. "LOOKING BACKWARD AT STEEL." *ANTIOCH REVIEW* 36 (FALL 1978): 441-462.

Interviews with two retired steelworkers, conducted by Lehigh University students, depict distinct reactions to jobs at Bethlehem Steel Corporation. One, an expert mechanic, derived much satisfaction and self-esteem from skills developed though his own initiative and talents. Though low paid, he believed his task important. The second interviewee, a union organizer, relates the harassment and brutality of the early years of organizing.

WEINGART, JEROME MARTIN. "THE 'HELIOS STRATEGY': AN HERETICAL VIEW OF THE POTENTIAL ROLE OF SOLAR ENERGY IN THE FUTURE OF A SMALL PLANET." *TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE* 12 (DECEMBER 1978): 273-315.

Over the next century it will be necessary to make a transition from reliance on fossil fuels to the use of long-term and primary energy forms. Of possible sources, only the fast breeder reactor and the sun are capable of supplying even the lowest of projected needs. For the solar option, the author concedes, some major engineering advances are needed. The paper proposes a global solar energy system that, given these advances, could support ten billion people enjoying modest energy consumption. This level should be well beyond that proposed by advocates of small-scale technologies or that which proponents of nuclear energy presently deem feasible for solar systems.

--Judith Mistichelli
--Christine Roysdon
Lehigh University Libraries

SYNOPSIS

Mankin, Donald. *Toward A Post-Industrial Psychology: Emerging Perspectives on Technology, Work, Education and Leisure.* New York: Wiley, 1978. (paperback)

Transforming industrial and organizational (I/O) psychology from a passive instrument of industrial-age ideology into an agent for post-industrial change requires modifications of the values, assumptions, and practices of traditional I/O psychology. This book proposes such modifications, integrating them with information and perspectives from other disciplines and subjects. It shows how a post-industrial psychology can contribute to an intentional, rational, and humanistic future.

Here is a unique approach that can be applied to problems and opportunities emerging from the interactions of organizations, technology, and society. Instead of focusing primarily on existing problems and issues of human behavior in industry, Mankin explores problems that transcend the boundaries of individual organizations. He discusses such broad societal concerns as unemployment and underemployment, the impact of resource shortages and technological innovation on the quality of work life, and the problems of leisure, elderly workers and retirement. Approaches are proposed that involve social policy initiatives as well as organizational programs.

This book can be used in courses on I/O psychology and organizational behavior and as a contemporary survey of these fields in courses on applied, introductory, and general psychology. And, it is appropriate for any specialized courses dealing with the relationships between organizations, technological change, the individual, the processes of industrialization, and the problems that may arise from these interactions.

Unpreviewed. Editor.
(Prof. Mankin, who is noted on our list of active scholars willing to visit campuses to lecture on STS topics [see issue #2, October 1977], is now located at:

University of Maryland University College
University Boulevard at Adelphi Road
College Park, Maryland 20742)

OPEN FORUM

INTERFACE '79,

the Third Annual Humanities and Technology Conference, invites your participation. Sponsored by the English and History Department of Southern Technical Institute, Marietta, Georgia, in conjunction with the Humanities and Technology Association, INTERFACE '79 will be held in Marietta, Georgia, October 25-27, 1979. Papers emphasizing the interaction and the common boundaries between the humanities and technology are welcome. Deadline for one-page abstracts is May 1, 1979. Direct inquiries and submit abstracts/papers to Drs. Roberta Gates and George Kennedy, Co-Directors, INTERFACE '79, Department of English and History, Southern Technical Institute, Marietta, Georgia 30060.

THE AMERICAN SOCIETY FOR MECHANICAL ENGINEERS,

Technology and Society Division, is requesting papers on the following topics for presentation at the Winter Annual Meeting in New York City, December 1979. Two copies of abstracts (200-500 words) or completed manuscripts of the papers may be submitted to: Professor A.M. Dhanak, Department of Mechanical Engineering, Michigan State University, East Lansing, MI 48824. The deadline for the abstracts: April 30, 1979.

Papers on the following topics will be considered to be especially suitable: (1) Technology assessment - analysis, forecasting, social impacts, ethical values, methodologies; (2) Energy and environmental assessments; (3) Assessments of solar energy and of other alternate energy sources; (4) Technology transfer - the use of new and innovative engineering practices in public sector management, technology transfer to Government Organizations and case studies; (5) Analysis and/or proposed models of engineering ethics; (6) Appropriate technology for developing and developed nations; (7) Socio-technical programs and ethics courses in engineering education; (8) Emerging technologies; (9) Legislative and legal problems relating to the role of technology; (10) General aspects dealing with interactions between technology and society.

Submitted abstracts or papers will be reviewed as to their appropriateness for the planned sessions and the authors will be notified of the acceptance of the papers for preprint publications and presentations.

LNS/cpf

a workshop

ETHICAL ISSUES IN HUMAN REPRODUCTION TECHNOLOGY: ANALYSIS BY WOMEN

will be held at Hampshire College in Amherst, MA from June 24-29, 1979. Sponsored by the Federation of Organizations for Professional Women and supported by the EVIST (Ethics and Values in Science and Technology) Program of the NSF, this project aims to explore the effects of introducing more direct imput by women into public and policy debates on the setting of research priorities and on the usage of reproductive technologies. Topics are grouped under the categories: (1) Ethical Dimensions of Contraceptive and Abortion Technologies; (2) Perinatal Ethical Issues; and (3) Engineering of Human Reproduction. Participants will be selected from professionals and concerned lay persons. Applicants from a wide range of disciplines and points of view are encouraged to apply. Project directors are Helen B. Holmes, Judith A. Ramaley, and Janice G. Raymond. For further information contact: EIRTAW, P.O. Box 1022, Amherst, MA 01002, or phone (413) 253-2063.

Humanities Perspectives on Technology
327 Maginnes Hall #9
LEHIGH UNIVERSITY
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HUMANITIES PERSPECTIVES ON TECHNOLOGY

Curriculum Newsletter of the Lehigh University HPT Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 12
June 1979

BEHAVIOR CONTROL AND HUMAN VALUES:

A COURSE REVIEW

In field after field the development of scientific knowledge has made possible technological novelties which present us with new value problems. This is true with respect to the technologies of war, of industry, of medicine, and such problems are becoming more obvious in the area of behavior modification and control. Claims are made, and evidence is produced which purports to show, that a technology of behavior control is now a real possibility. Perhaps nothing else, with the possible exception of genetic engineering, poses the problem of technology and human values so sharply as this new potential.

In order to deal with the questions raised by these new possibilities, a team-taught course by a psychologist (Arthur Brody) and a philosopher (Norman Melchert) has been offered for the past three years at Lehigh University. It is truly a team project. Both of us are in the classroom together. And while it is usually the case that one or the other of us takes the lead during a class session, it seldom happens that the other just listens. The course has a lower division number, but requires one course in either psychology or philosophy as a prerequisite.

The first task is to get clear about the technology in question; and that means getting some understanding of the scientific principles presupposed by the technology. Although the field of behavior control is a broad one, including the use of drugs, psychotherapy, electrical stimulation of the brain and psychosurgery, we have limited ourselves to the possibilities suggested by the principles of operant conditioning. The value questions arise here as insistently as anywhere, and the applications seem less likely to be limited to use with single individuals than the other techniques. This latter point is of some importance, since it seems to promise the possibility of designing or re-designing a whole culture.

The early part of the course, then, is devoted to understanding the following concepts and the principles based on them: reinforcement (positive and negative), punishment, shaping and schedules of reinforcement. Applications of these principles in modifying the behavior of pigeons, rats, and monkeys are made vivid by the use of a film. And that the same principles have at least some application to the behavior of humans is dramatically illustrated by another film showing successes in treating autistic children, retarded children, and adult schizophrenics by these methods (the last involving a token economy, thus making clear the important notion of secondary reinforcers).

Contrasts of two kinds are then drawn to this behavioristic explanatory model. It is contrasted first with other explanatory views in psychology, in particular with "intrapsychic" views such as that of Freud. In these views, behavior is explained in terms of certain internal states, mechanisms, drives or needs. Id, Ego, and Super-Ego are well-known concepts in an intra-psychic view.

The second contrast is with the way we ordinarily think of ourselves and others. This can be thought of as a rudimentary theory of human behavior which is embedded in common sense, ordinary language, and everyday ways of reacting to each other. Its keystone is the distinction between *actions* (what people *do*) and mere *happenings* (what people *undergo* or *suffer*). The former are explained (in this proto-theory we call "the manifest image of man") in terms of reasons the agent has for performing his actions; and reasons are explicated in terms of beliefs and desires. Jones goes to the dining hall because he wants to eat and believes they are now serving. It is in the purposive, teleological, intentional character of action-explanations in the manifest image that we get a sharp contrast with the mechanistic explanations of behavior theory.

This contrast sets up one of the main problems the course is focused upon. Supposing that action-explanations of a mechanistic sort can be given (whether purely behavioral or by way of a physiological analysis), is this incompatible with holding persons responsible for their actions? There is a division of opinion about this which we examine in some detail.

There are those--B. F. Skinner is the most relevant example--who hold that if men's actions are completely determined by causal conditions, then it is improper to hold them responsible for their actions. This is one of the main themes of *Beyond Freedom and Dignity*: The environment is responsible, and we (though not responsible for our actions either) can control the environment, and so control behavior. This view, that causal mechanism entails the denial of freedom, dignity, autonomy, and responsibility, we call "hard determinism."

Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

Against this the "soft determinists" argue that the entailment fails. For, they say, within a completely deterministic system creatures such as men can be called "free" and can have a sufficient degree of autonomy to make it reasonable to hold them responsible. Jones is free to do A, in this sense, if he can both do A and refrain from doing A; i.e., if he can do otherwise than he in fact does do. And he can do otherwise *if* his doing what he does do is neither compulsive, nor coerced, nor constrained. We have a case of free action on our hands, then, if the action flows from the person's rational beliefs and desires even though these in turn are subject to causal determinism.

One of the crucial practical issues involved in the above division of opinion is that of punishment. Skinner argues that a world without punishment is a possibility, control of behavior being accomplished by positive reinforcement of desired behavior patterns. It is not only a possibility, it is desirable because of the inefficiency of punishment in stopping "bad" behavior and its efficiency in producing undesirable side effects.

Herbert Morris, assuming that violations of agreed-upon rules will occur, contrasts two ways of dealing with the violators. He sets up two models, or ideal types, of institutions: one is a punishment model and the other a treatment model. The burden of his argument is that the rights of persons are much more likely to be disregarded in a society embodying the treatment model than the punishment model.

The contrasts between these models and comparisons of them with what Skinner says about punishment stimulate some quite lively discussion.

Given the assumption that the control of behavior is possible by using the principles of operant conditioning, questions of value and moral decision inevitably arise: to what end shall this technology be used? who is to decide? how shall the controllers be controlled?

In addressing these questions some reflection on the nature of value and moral judgments is called for. Are they statements of prevailing norms? Are they descriptive of some facts about human nature? Are they merely expressive of an individual's feelings? Or do they represent a rational decision as to what ought to be done? If the first is correct, moral criticism of society's values seem to be impossible. If the second, as Skinner seems to urge, then the behavioral scientist might be looked to as an expert in how we ought to use behavioral technology. If the third, the contribution of rational thought to a discussion of these matters would surely be minimal. If the fourth view is correct, some explication is required to show how facts and reasoning combine with imagination to yield non-arbitrary, though not scientific, decisions.

These are large questions, naturally, and nothing like full justice can be done to them in this course. We concentrate on the second and fourth, using Skinner and William Frankena, respectively, as resources. Skinner tends to identify good with what leads to survival, and this has a very natural connection with the notion of positive reinforcement. From such a "descriptivist" ethical stance, any use of behavioral technology is acceptable, provided it leads to survival--ultimately to the survival of a culture. Thus there are good reasons to provide reinforcements to people for "behaving for the good of others." And that society will most likely survive which has a sizeable proportion of its population acting to promote its survival.

In terms of this schematism, Skinner believes he can answer the question about controlling the controllers. Where control leads to an inequitable balance of goods received on the parts of the controllers and the controlled, the situation is unstable: that society will not survive. Since survival is the crucial value, that is a bad society; only a reasonably "just" society can be a good one.

Frankena argues that the close connection between moral judgments and action precludes any merely descriptivist analysis of value terms. To say that x is good is not just to describe it (as, perhaps, something that leads to survival). It is to commend it. And to say that we ought to do a certain action is to prescribe that it be done. Moreoever, there is a universal aspect to moral judgments; so that in saying "A is the right thing to do" we are subscribing to a principle which would apply to anyone in the relevant circumstances who was faced with doing or not doing A. What is called for when we face a moral choice is a decision, and no decision can be entailed by any pure description of the state of affairs.

In terms of these concepts, we sketch a model of moral reasoning which takes into account the facts and all the interests of those concerned; this model we take to be useable when facing such questions as we are concerned with. We mean to provide students with a method for thinking through value questions as rationally as possible.

We are confronting our students, then, with two paradigms in terms of which these matters can be discussed. As a matter of fact, Brody favors one of these and Melchert the other; so the differences have some existential embodiment. These matters are not, moreover, just academic wrangles. They have a very practical bearing on the lives of the students and the future of our culture.

Both of these features seem to be recognized and appreciated by the students. The practical importance of these issues is apparent to all. And in a course evaluation by the students at the end of the semester, they singled out the team teaching by a psychologist and a philosopher for overwhelming approval. There are alternative points of view on these questions, and they obviously were glad not to get just one of them.

Students have been required, as we have

taught the course so far, to take three exams and write a term paper. The first exam covers the introductory section of operant conditioning and is an objective, largely multiple choice test. The other two are essay exams, testing comprehension of the readings. The paper is a research paper requiring considerable reading beyond the assigned books and articles. We have left the choice of topic quite flexible, and it may be primarily on the psychological side or primarily on the philosophical.

Both of us have repeatedly expressed, to each other and to other persons, how much we have profited from participation in the course. Each has learned from the other, both positively and in terms of mutual, friendly but acute, criticism. The joint exploration in depth of a practical problem which has both psychological and philosophical components can only deepen our understanding, whether one comes at the problem from the psychological or the philosophical perspective.

--Arthur Brody
Dept. of Psychology
--Norman Melchert
Dept. of Philosophy
Lehigh University

RESOURCES

1. BOOKS AND ARTICLES CURRENTLY USED

   a. B. F. Skinner, Beyond Freedom and Dignity.

      This book is used to explore one of the two paradigms referred to above, the hard determinist stance with a behaviorist cast to it. We try to help students do two things: (1) to understand it as sympathetically and accurately as possible, and (2) to understand some of the major criticisms which can be and have been made of the book.

   b. William Frankena, Ethics.

      A good introductory discussion of the various ethical theories, with an attempt to come to some resolution of the differences among them.

   c. Alan Kazdin, Behavior Modification in Applied Settings.

      A discussion of the theory of operant conditioning, together with consideration of applications to personal behavior change and institutional uses of the techniques.

   d. Robert L. Geiser, Behavior Mod and the Managed Society.

      How behavior modification techniques are being used, from a primarily critical standpoint.

2. We have also used:

   a. Aldous Huxley, Brave New World and Brave New World Revisited.

   b. B. F. Skinner, Walden Two.

   c. R. M. Hare, Freedom and Reason.

   ---and a variety of articles put on reserve, including

   1. Herbert Morris, "Persons and Punishment," The Monist 52, (October 1968): 475-501.

   2. W. D. Falle, "Gooding and Guiding," Mind 62, (April 1953): 145-171.

   3. Gilbert Fulmer, "Skinner's Values," The Journal of Value Inquiry 10 (Summer 1976): 106-18.

3. BIBLIOGRAPHIES

   a. Bibliography of Society, Ethics and the Life Sciences. The Hastings Center, 623 Warburton Avenue, Hastings-On-Hudson, NY 10706.

   b. Bibliography of Behavior Modification, 1924-1975. Morris F. Britt, 3000 Erwin Road, Durham, NC 27705.

4. AUDIO-VISUAL AIDS

   a. Movies

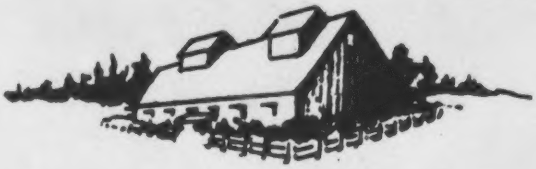
      1. "Behavior Theory in Practice." A film showing the behavior of pigeons, rats, monkeys and dogs being shaped and controlled by applying the principles of operant conditioning.

      2. "Reinforcement Therapy." A film showing how autistic children can be taught to communicate and enter into normal relations with others, how retarded children can be taught to read, and schizophrenics to assume responsibility for their behavior--all using techniques of behavior modification.

   b. Audio tapes

      1. "The Work of B. F. Skinner," R. R. Hergenhahn, Lansford Publishing Co., San Jose, California.

      2. A series of nine cassette tapes from Skinner's participation in a colloquium at the Center for the Study of Democratic Institutions, Lansford Publishing Co., San Jose, California.



READINGS IN TECHNOLOGY AND CULTURE

The Program for the Study of Technology at West Virginia University is a broad-based graduate program which provides students with the opportunity to focus on a particular aspect of technology. Examples of these areas of concentration include production, communication, transportation, appropriate technology, history of technology, socio-technical interactions, and international transfer of technology. Each student, in conjunction with a faculty committee, designs a program of study based on a stated philosophy, goals and objectives determined by the student.

All students are required to take a group of five core courses which provide a cohesive element to the Program. These courses allow the students to develop an overview of the study of technology and technological systems, the relationship of these systems to the civilizational process, and the implications of change in these systems to future citizens. The five core courses include:

1. Technology: Its History and Development
2. Readings in Technology and Culture
3. Technical Developments in Communication, Production or Transportation
4. Contemporary Problems in Communication, Production or Transportation
5. Interdisciplinary Seminar on Technology

The Readings in Technology and Culture course consists of a survey and analysis of selected readings regarding the relationship between technology and culture. The purposes of the course are a) to develop an understanding of the impact and effect technology has had, is having, or is anticipated to have on the various segements of our culture and society; and b) to develop an overview of the major technology-related writings from other disciplines.

The overall topic is broken down into 15 sub-categories. For each meeting, the students are responsible for the analysis and synthesis of a required reading, at least one reading from a group of annotated readings, and at least one reading located by the student that is related to the sub-topic under discussion.

The required readings came primarily from two sources: *The Technological Society*, by Jacques Ellul (Vintage Books, 1964) and *Technology, Change and Society*, by Edward C. Pytlik, Donald P. Lauda, and David L. Johnson (Davis Publications, 1978). The lists of annotated readings for each category vary each semester as new authors/articles/books are discovered or written. A list of the sub-topics and the required readings and a sample annotated bibliography for each sub-topic is described below.

Since the reading load is fairly substantial, no term papers or periodic exams are required during the semester. However, the students are required to complete an annotation card on the weekly reading they located. Also, on a rotational basis, the students are responsible for recording and synthesizing the class discussion, and to type, reproduce and distribute this synthesis to the other class members. Finally, a take-home final exam is given at the completion of the course. The exam focuses on the student's ability to apply the material learned during the semester to problem-solving situations.

--Edward C. Pytlik
Program for the Study of Technology
West Virginia University

Course outline and exam follow. (Editor)

TOPICAL OUTLINE
and
READINGS

1. *The Nature of Technology*

Required Reading

Ellul: Introduction and Chapter 1
Pytlik, et al.: Chapter 1 & 4

Annotated Reading List

Muller, H. The Children of Frankenstein (1970).
Pirsig, R. Zen and the Art of Motorcycle Maintenance (1974).
Zvorkine, A. "Technology and the Laws of its Development," in C. Stover (Ed.) The Technological Order (1953).
DeVore, P. "The Nature of Technology" in Proceedings of the American Industrial Arts Association 32nd Annual Convention (1970).

2. *Philosophical Considerations*

Required Reading

Ellul: Chapter 2

Annotated Reading List

Ferkiss, V. "Toward the Creation of Technological Man" in Technological Man: The Myth and the Reality (1969).
Marcuse, H. One-dimensional Man (1964).
Lewis, C. S. "The Abolition of Man" in The Abolition of Man (1974).
Schumacher, E. F. A Guide for the Perplexed (1977).

3. *Economic Considerations*

Required Reading

Ellul: Chapter 3

Annotated Reading List

Daly, H. "An Overview of the Issues"in Steady State Economics (1973).
Galbraith, J. "The Imperatives of Technology" in The New Industrial State (1967).
Heilbroner, R. The Wordly Philosophers (1967).
Schumacher, E. F. Small is Beautiful (1973).

4. *Technology and Politics*

Required Reading

Ellul: Chapter 4

Annotated Reading List

Ophuls, W. "Locke's Paradigm Lost: The Environmental Crisis and the Collapse of Laissez-Faire Politics" in Beyond Growth - Essays on Alternative Futures, W. Burck and F. H. Bormann (Eds.) (1975).
Dickson, D. "The Politics of Technical Change" in The Politics of Alternative Technology (1975).
Rotenstreich, N. "Technology and Politics" in C. Mitcham and R. Mackey (Eds.) Philosophy and Technology (1972).
Boorstin, D. "Political Technology: The Constitution" in The Republic of Technology (1978).

5. *Technology's Impact on Societal Institutions*

Required Reading

Ellul: Chapter 5
Pytlik, et al.: Chapter 3

Annotated Reading List

Fromm, E. "Where are We Now and Where are We Headed" in The Revolution of Hope (1968).
Russell, B. "The Effect of Science on Social Institutions" in T. Hughes (Ed.) Changing Attitudes Toward American Technology (1975).
Florman, S. The Existential Pleasures of Engineering (1976).
Hardin, G. "The Tragedy of the Commons" in F. Olsen (Ed.) Technology: A Reign of Benevolence and Destruction (1973).

6. *Technology and Education*

Required Reading

A. Toffler, Future Shock: Chapter 18

Annotated Reading List

Burke, J. "Education in a Technological Era" in The New Technology and Human Values (1966).
Leonard, G. Education and Ecstacy (1968).
Margolis, R. "Programmed Instruction: Miracle or Menace" in A. deGrazia and D. Sohn (Ed.) Revolution in Teaching (1964).
Barr, D. "The Technology of Education" in Who Pushed Humpty Dumpty? (1971)

7. *Technology, Work, and Leisure*

Required Reading

Pytlik, et al.: Chapter 12

Annotated Reading List

Vonnegut, D. Player Piano (1952).
Terkel, S. Working (1972).
Neff, W. S. Work and Human Behavior (1974).
Kaplan, M. and Bosserman, P. (Eds.) Technology, Human Values and Leisure (1971).

8. *Technology and Medical Practice*

Required Reading

Pytlik, et al.: Chapter 11

Annotated Reading List

Calder, N. "Biological Conundrums" in Technopolis (1969).
Dubos, R. "The Biomedical Control of Human Life" in Man, Medicine and Environment (1968).
Hamburger, J. and Haley, M. J. "Public Health" in H. Nash (Ed.) Progress as if Survival Mattered (1977).
Greifinger, R. and Sidel, V. "American Medicine" Environment (May 1976).

9. *Technology and Religion*

Required Reading

H. Cox, The Secular City, pp 1-90, 145-166.

Annotated Reading List

Finnerty, A. "Global Redesign" No More Plastic Jesus (1977).
Miller, S. "Religion in a Technical Age" in Religion in a Technical Age (1968).
Tillich, P. "The Person in a Technical Society" in G. Winter (Ed.) Social Ethics (1968).
Barbour, I. "Attitudes Toward Nature and Technology" in Earth Might Be Fair (1972).

10. *Technological Development and Social Change*

Required Reading

Pytlik, et al.: Chapter 5 & 6

Annotated Reading List

Chodak, S. Societal Development (1973).
Drucker, P. The Age of Discontinuity (1968).
Foster, G. Traditional Societies and Technological Change (1973).
Farmer, R. W. Benevolent Aggression (1972).

11. *Technology Transfer*

Required Reading

Pytlik, et al.: Chapter 7

Annotated Reading List

Lele, U. The Design of Rural Development (1975).
Nair, D. Blossoms in the Dust (1967).
Nash, M. Machine Age Maya (1958).
Berry, W. "Margins" in The Unsettling of America (1977).

12. *The Energy Question*

Required Reading

Pytlik, et al.: Chapter 9

Annotated Reading List

Freeman, S. D. Exploring Energy Choices (1974).
Garvey, G. Energy, Ecology, Economy (1972).
Cook, E. "The Physical Economy of Energy Use" in Man, Energy and Society (1976).
Lovins, A. "Energy Strategy: The Road Not Taken" Foreign Affairs (Nov. 1976).

13. *Technology and the Environment*

Required Reading

Pytlik, et al.: Chapter 8 & 10

Annotated Reading List

Lawless, E. Technology and Social Shock (1977).
Commoner, B. The Closing Circle (1972).
Carson, R. Silent Spring (1962).
Rodda, M. "Noise" in J. Rose (Ed.) Technological Injury (1969).

14. *Technology Assessment*

Required Reading

Pytlik, et al.: Chapter 13

Annotated Reading List

Rowe, W. An Anatomy of Risk (1977).
Kasper, R. G. Technology Assessment (1972).
McHale, J. The Future of the Future (1969).
Toffler, A. The Futurists (1972).

15. *Which Way Now? The Future*

Required Reading

Ellul: Chapter 6

Annotated Reading List

Reich, C. "The Coming American Revolution" in The Greening of America (1969).
Kahn, H. and Wiener, A. "Comments on Science and Technology" in The Year 2000 (1967).
Fabun, D. "Foreseeing the Unforeseeable" in Dynamics of Change (1976).
Mumford, L. "Technics and Human Culture" in Human Futures (1973).

Take-Home Exam

Readings in Technology and Culture

Directions

The exam consists of 12 questions separated into three sections. You are to answer 6 of these questions, two from each section.

Section A.

1. In The Technological Society, Ellul states "economic technique is almost entirely subordinated to production, and ranges from the organization of labor to economic planning." (p. 22).

    (a) What precisely does Ellul mean by "economic technique?"
    (b) Select at least two other authors who discuss economic technique (even though it may be labeled something else) and discuss how they perceive it.
    (c) In your own terms, how would you define economic technique?

2. Ellul states, "In discussing technique today it is impossible not to take a position." In your opinion, is Jacques Ellul's position one of optimism or pessimism? Defend your position with passages from his writings, reviews, critiques, and other publications on Ellul and The Technological Society.

3. In your own words describe Schumacher's Four Fields of Knowledge. In an optimum society, how would you incorporate these ideas into your personal lifestyle?

4. The sub-title to Schumacher's book Small is Beautiful, is "Economics as if People Mattered." Describe the optimum world economic situation/strategy according to Schumacher as described in this text.

Section B.

5. If Jacques Ellul was having a discussion with E. F. Schumacher, on what points would they agree? On what points would they disagree? Substantiate your position with direct quotations from their respective texts.

6. There are persons who feel that by transferring our high level technology to developing nations we are exploiting the populations of these nations. How does the exploitation take place? Who are some of the major proponents of this theory? What do they propose as alternative solutions? Be explicit.

7. What is "progress?" to you; to an economist; to an engineer; to a sociologist; to an educator; to a middle-class American; to a peasant farmer in India? Seek direct quotations or paraphrase comments as much as possible.

8. The law of supply and demand is a philosophical abstraction. Currently, supply seems to be limited only by our ability to produce, and demand limited only by our ability to consume. These limits are producing great stress on our environment. Develop the positions of at least three writers who have proposed solutions to this dilemma.

Section C.

9. You have just been appointed Director of the Energy Development Commission for the State of West Virginia. You have a mandate from the Governor to get the people of this State to reduce their gasoline consumption by 30% and their home energy consumption by 50%. Develop a plan of action to comply with this mandate using actual statistics, logical sequencing, practical theoretical models, realistic time frame, etc., and a minimum of conjecture.

10. You have just been appointed Minister of Resources for a small developing nation. As Minister the major problem you face is to create a large, efficient, but at the same time, economical supply of energy so that your country can move ahead with its development plans. Two other major interrelated problems in your country are overpopulation in the mountainous regions and an adequate food supply. Topographically, one-fourth of the country is covered by high mountains which collect all of the moisture from passing clouds. As a result of this moisture collection, the other three-fourths of your country is desert wasteland. The mountain range has an excellent forest cover and is also where 80% of the population live.

    Assuming that no natural resources are to be found underground (coal, oil, uranium, geothermal) what would you choose as your major source of power? Explain your choice in detail. Include reasons why you did not choose other potential sources.

11. You have been given the job of making the final decision on whether or not to continue development of the cross-Florida Barge Canal. Outline your final report. Include all the reasons why the project should be continued, all the reasons why the project should be discontinued, what your final decision is and why you made the decision you did. Substantiate your report with direct references.

12. You are the supervisor of a manufacturing complex that makes and assembles refrigerated railroad cars. Your workers have gone on strike, not for higher wages, but for more humane working conditions. They are primarily concerned with noise and dust levels, tediousness of work, lack of representation at management level, vacation time, etc. Your plan of action is to study the reports compiled by the automobile industry when they had similar problems and psychological research studies regarding worker satisfaction. Discuss in detail your findings and the approach you would take to solve the problems that caused the strike.

IS THERE LIFE OUTSIDE THE MACHINE?

I suppose it takes something precisely like a gas shortage to remind us that we live in the Machine, so, fresh from visions of furrowed brows and long lines at the local gas station, I'm going to recommend some man/machine stories for summer reading or next semester's syllabus.

The archetypal "cocoon dystopia" is E. M. Forster's "The Machine Stops" (collected in his *Eternal Moment and Other Stories*, 1928). Civilization moves underground into the Machine which provides total material comfort and happiness to individuals in isolated niches, much like cells in a beehive. There is a button for everything, but the price for this paradise is physical and moral atrophy. Since everything is plugged into the Machine, civilization dies -- horribly -- when the Machine stops, though some hope is given to a remnant which has learned to live "outside."

Diaspar in Arthur C. Clarke's *City and the Stars* (1956) has the shopping mall glitter you may have noticed in the fairly recent *Logan's Run* movie. (Have you also noticed what George A. Romero has done with the mall as symbol of modern society in his just released *Dawn of the Dead* film?) It is one of those small technological pleasure domes which dot the science fiction landscape. This eternal city, a universe unto itself, resting like a glowing jewel on the breast of a desert, is a triumph of social engineering, a perfect mesh of people and environment. Cushioned by seductive machinery and a comfortable mythic history, however, this city is also an "artificial womb," a "frozen culture," and the central character's "escape" to the stars causes a beneficial breaking of barriers and a stimulating new contact with reality.

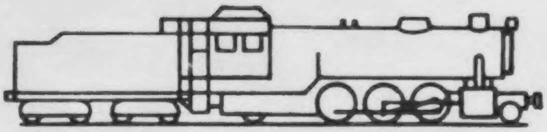
Isaac Asimov's *Caves of Steel* (1954) is a mystery story set a few thousand years in the future, when New York is a vast domed city of 20 million people, which turns on the fact that earthmen no longer go outside. The cave of steel is a technological marvel, an inevitable evolution in the face of growing population, but overall it is not sympathetically drawn. The system is straining, severe organization turns people into powderkegs, the delicate balance is vulnerable to the slightest perturbation. A C/Fe culture is the answer (carbon/ferrum); life with the machine, not in it, is the answer; and a detective's ability finally to work with a robot is the key symbol of success.

The humanoid servants who transform the world in Jack Williamson's "With Folded Hands" (collected in Robert Silverberg's *Men and Machines*, 1968) are programmed "to serve and obey and guard men from harm," but the story emphasizes that man must be altered either physically or psychologically to really benefit from such service. For those who are strong and rashly attempt to fight the machines, physical alteration, a lobotomy, renders them blankly harmless; for the weak and easily initimidated remainder of humanity, psychological alteration, voluntary submission to a life with folded hands, renders them "perfectly happy."

The injunction "to serve and obey and guard men from harm" can mean, ironically, that the machines must save man from himself. Thus, in "Folded Hands," in Lewis Padgett's "The Twonky" (also collected in Silverberg), and in John Sladek's "The Happy Breed" (collected in Harlan Ellison's *Dangerous Visions*, 1967) there is a graphic and comic restriction of "normal" human activity and choice. Windows don't open because a man might accidentally fall out; machines operate water taps because a suicidal human might try to drown himself; the harmless pastime of milking a cow is permitted only when the cow is tranquillized and fastened in a steel frame; a second cup of coffee and the reading of detective stories are forbidden. When man tries to resist such logical service, he is "eliminated" (Padgett), or treated as abnormal and packed in glass cases under the uterine control of Med-central (Sladek).

And if you are really looking for something grim, read Harlan Ellison's "I Have No Mouth, And I Must Scream" (collected in his *Alone Against Tomorrow*, 1971), where the last human belly slave of the computer is transformed into "a great soft jelly thing," with no mouth, with pulsing fog filled holes for eyes, with rubbery appendages for arms, with humps of soft slippery matter for legs. Look around you in the gas lines!!!

--Edward J. Gallagher
Department of English
Lehigh University



CURRICULUM AIDS:

A CONFERENCE REPORT

In late March I attended a workshop on STS instructional aids sponsored by the Pennsylvania State University Science, Technology, and Society Program. The organizers saw the workshop's major purpose as a forum for presenting and analyzing a range of teaching aids from traditional texts to audio-visual materials and modular units. One of the most exciting, but at the same time demanding, aspects of interdisciplinary interaction is the preparation and use of instructional material. Because of the diverse nature of faculty and courses and hence needs, traditional textbooks are frequently unsuitable for many classes. A generally perceived need in the field is for modular aids of all kinds --print, television, film, etc.-- treating specific topics, which can be variously combined to meet almost any need. A second, less-focused aim was to bring together educators from a variety of spheres including publishing, pre-college, and continuing education as well as the college level, where most STS activity is presently taking place, for informal discussion of the curriculum issues in this rapidly expanding field.

F. James Rutherford, Assistant Director of the Education Directorate, of the National Science Foundation, gave the keynote address on "Science, Technology and Society at the Pre-College Level." He emphasized the need to provide an adequate general education in the public schools which would prepare the student to fit into society. In this age of science and technology, that should include an understanding and appreciation of their social impact. At present this is inadequately emphasized. In part, the answer lies in the revision of standard science texts to include STS issues, the development of modular material, and more extensive teacher training in the area, both pre-service and in-service. He concluded his comments by noting NSF's expanding commitment to these areas.

The keynote address was followed by two others during the morning of the first day. John Truxal of the College of Engineering and Applied Science at SUNY-Stony Brook spoke on the "Experience with Curriculum and Materials in a College Level STS Program." The Stony Brook effort takes place at four levels: STS research projects; the interdisciplinary Federated Learning Community described in the June 1978 No. 6 issue of this newsletter; STS courses offered in traditional departments, mostly the sciences; and the Department of Technology and Society located in the college of engineering. He concluded his presentation by describing several mini-teaching modules on topics such as supermarket automation and automobile safety which have been developed at and are available from Stony Brook. Ted Sherburne, the Director of Science Service, Inc. of Washington, D. C. and the publisher of Science News, wrapped up the morning session by addressing the issue of "Mass Communication STS Aids." He outlined a three-part model for bringing an awareness of science to the public via the mass media.

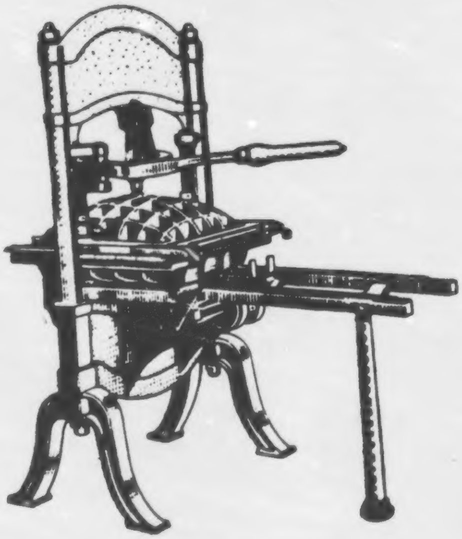
The three addresses provided something of a jumping off point for smaller afternoon workshop sessions which covered the pre-college, college, and continuing education levels. Each of the sessions was designed to provide individuals an opportunity to present and share with other participants materials with which they had had experience at a particular level. At the pre-college level it was generally agreed that while there was material available, many teachers were unaware of it or lacked the experience to make effective use of it. Thus, recommendations included better communications with the college level where most of the innovating presently takes place and improved science education with respect to STS issues for teachers, both pre-service and in-service. At the college-level workshop, which was most heavily attended, participants described individual courses and programs, and in some cases distributed materials. In addition, several new texts and aids were announced. The brief discussion which followed focused in part on how to make this material and experience readily available, a point which was further developed during the plenary session. The continuing education and mass media group was the smallest numerically and met informally for a brief discussion on pertinent issues. These workshop sessions concluded the formal portion of the first day's events.

As with most conferences, the informal discussions centering around coffee breaks, displays of instructional aids during the afternoon of the first day, and the dinner table that evening proved to be at least as valuable as the planned sessions. These contacts and the plenary session held during the morning of the second day were for me the most productive aspects of the two-day gathering. Several major points emerged. Perhaps most important was the widely felt need for legitimacy. Certainly everyone attending felt the legitimacy of STS activities; however, despite increased numbers of college courses and movements such as that of ecology on the public level, there was still a sense of operating outside the mainstream of academic, disciplinary, and societal institutions and norms. On all levels, the solution appears to be continued hard work based on solid research to convince those who make institutional decisions and hold the purse strings.

A second major concern was the development of relevant teaching materials which will help in broadening the awareness of citizens from grade schoolers to the public which is outside traditional educational structures. Directly tied to this development was the recognized need for some sort of distribution system. At present there is no single journal or center to coordinate even the existing material, which is surprisingly large. Suggestions included the founding of an STS Center with a catalogue for listing material available for distribution. A complimentary suggestion was the establishment of a reprintable journal which would avoid many of the problems of copyright reproduction. Many other useful and intriguing thoughts emerged from these discussions including the importance of doing interdisciplinary STS research and the value of establishing local-area STS colloquia which would involve people from government and business as well as academics.

While no "manifesto", so to speak, emerged from the two days, the mere gathering of those involved and the consensus that what was being done for students and the public at all levels was most important is a hopeful sign. As with any young and emerging field, it will take many such like-minded conferences and workshops to form a coalescence of ideas and approaches. Through the emergence of new journals (see the review following) and newsletters such as this, we hope to bring to attention new developments in the STS field such as instructional materials as they become available. Readers with ideas and materials are invited to share in this growing field.

--Stephen Cutcliffe
Editor



Doing It /cpf

TECHNOLOGY IN SOCIETY

No one would argue the rapid increase of interest in Science, Technology, and Society (STS) studies amongst educators, whether it be at the pre-college, college, or continuing education level. Concomitant with and serving as an indicator of this growing interest is the rapid expansion of newsletters and journals in the field.

The newsletters and journals generally fall into two categories: those that deal interdisciplinarily with the field such as Science, Technology, and Human Values: An Interdisciplinary Quarterly Review produced at Harvard University, STTH (Science/Technology, and the Humanities) published under the auspices of Florida Institute of Technology and our own HPT Curriculum Development Newsletter and those that focus on a specific discipline such as Technology and Culture, the quarterly journal of the Society for the History of Technology, and the Newsletter of the Society for Philosophy and Technology. While this list is by no means exhaustive, it is representative of some of the better material available today. Thus, it was with some interest that I noted another addition to the field, Technology in Society. What could this entry offer that the others failed to provide --scholarly articles, news items, bibliographical updates and book reviews? Is all this activity superfluous or a dissipation of talent and scholarship? Only time will tell of course, but happily it appears to fill a niche not completely covered by the others.

Technology in Society is interdisciplinary in its content and approach, at least as far as can be gleaned from the first number which appeared as the Spring 1979 issue. The editors, George Bugliarello and A. George Schillinger, both of Polytechnic Institute of New York, claim three objectives: "the first is to explore how technology affects our society in its many aspects --organization, government, social structure, national security, the family, and individual personality. The second is to study the ways in which social processes and attitudes lead to technological decisions-- on how the thinking of engineers, architects, union leaders, government officials and the general public influences the character and diffusion of technology in our society. The third objective is to identify combinations of technological or social choices open to us, and their effects on our society."

The articles in this first number reflect the attempt to develop a truly interdisciplinary forum for technology studies, a forum devoted "to exploring how, in a rational way, we can assess the risks, the impacts, and the opportunities of technology...the difficult choices that require enlightened decisions and institutions capable of making the choices effectively." While these essays are typical of exploratory ventures in a new journal, they mark the way for future endeavors and include:

Harvey Brooks' *Technology: Hope or Catastrophe?*; Harlan Cleveland's *Do Global Technologies Require Global Politics?*; Edward Wenk's *Political Limits in Steering Technology: Pathologies of the Short Run*; Edward Teller's *Nuclear Energy and the Interdependence of Nations*; Hans Mark's *The Impact of Our Enterprise in Space*; Peter Glaser's *The Potential for Solar Energy Development*; Mario Bonge's *The Five Buds of Technophilosophy*; and Langdon Winner's *The Political Philosophy of Alternative Technology: Historical Roots and Present Prospects*.

See the META bibliographical section in this issue for brief annotations of the Brooks, Wenk, and Bonge articles. Winner's essay is reprinted from Essays in Humanity and Technology, which was reviewed in the September 1978 issue of this newsletter.

The editors have set for themselves a large task, but if successful, one which will aid us all. *SHC*

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CONNECTIONS: TECHNOLOGY AND CHANGE

OR THE DETECTIVE GENRE IN THE HISTORY OF TECHNOLOGY

Sherlock Holmes, notwithstanding, *Connections* may prove to be one of the more rewarding television detective stories to hit the silver screen in recent seasons. BBC and Time-Life Films have combined to produce a ten-part history of technology, in the vein of Clark's *Civilization* and Bronowski's *Ascent of Man*, to be aired nationwide on a weekly basis on the Public Broadcasting Service network beginning the first week in October, with repeat showings later in each week. James Burke, a BBC producer, serves as master sleuth and narrator of the series. It is his thesis that "technological change occurs in response to a variety of contributing factors --which he calls 'triggers'-- some of them seemingly unrelated. In turn, these technological innovations have their own triggering effects, causing change not only in their own fields, but in totally unrelated fields as well."

After laying out his thesis in the first program, Burke then traces the history of eight modern inventions --the atom bomb, telecommunications, the computer, the production line, the jet air craft, plastics, rocketry, and television-- from their ancient and medieval antecedents, searching for these "triggers." The series concludes with a program on future prospects.

Accompanying the television series will be a related fifteen-week newspaper course "Connections: Technology and Change," developed by the University Extension of the University of California, San Diego, which is scheduled to start in mid-September and end shortly after the television series. Although it may be carrying the metaphor too far to type John Burke, Professor of History at UCLA, as the Watson of this search for technological understanding, he more than ably coordinates the thought of fourteen top scholars in the field. In his introductory article, "Technology on Trial," Burke notes both the contributions and negative impact of technology upon our society and values. He suggests that to assess our present situation, to judge its uniqueness, it may be helpful to look at the development of technology in its historical context. The remaining articles in the series are devoted to that goal. Authors and titles in the order in which they will appear include:

TECHNOLOGY'S EFFECTS

Peter Drucker - "Silent Revolutions"
Derek de Solla Price - "How Terribly Technical"
Joseph Gies - "Occupational Destinies"

CONDITIONS OF TECHNOLOGICAL DEVELOPMENT

Clarence Glacken - "Culture, Nature, and Technology"
Edwin Layton - "The Influence of Societal Values"
Kingsley Davis - "Technology and Health"

SOURCES OF TECHNOLOGICAL CHANGE

Nathan Rosenberg - "Technology and Economic Growth"
Robert Multhauf - "Science and Technology"
Eugene Ferguson - "The Imperatives of Technology"
Herbert York - "Wars: Hot and Cold"
Hunter Dupree - "The Government's Role in Technological Change"

RETROSPECT AND PROSPECT

Lynn White - "The Mystery of Inventiveness"
Bertram Morris - "Technology and the Seamless Webb: Ethical Dilemmas"
Melvin Kranzberg - "Assessing and Directing Technology"

The educational package which combines the television and newspaper series is rounded out by the publication of several texts. All the items use the key title phrase *Connections*. John Burke has edited a reader with optional study guide, entitled *Technology and Change*, designed to supplement the newspaper course. The essays include a variety of contemporary pieces, articles drawn from scholarly journals, and excerpts from recent monographic literature. It is available from Boyd and Fraser Publishing Company, 3627 Sacramento St., San Francisco, CA 94118 for $6.95 or $9.95 with the study guide. A smaller *Viewer's Guide*, also available from Boyd and Fraser, relates the Burke reader to the television series by more fully developing the issues raised regarding technology's impact on society. Individual orders for the *Guide* are $2.95, but must be prepaid and should include an additional 50 cents for postage and handling. Finally, James Burke has written a 300-page, ten-chapter text, entitled *Connections*, which corresponds directly with the television series. It will be available from Little, Brown and Co., Boston, MA in mid-to-late summer for approximately $18.00.

For those students and faculty taking the course by newspaper, Boyd and Fraser has put together a package of material at a special reduced price. You may order both *Technology and Change* (the reader/study guide) and the *Connections* text for $22.45. For those unable to take the newspaper course, a booklet version of the newspaper articles will be available for purchase. (This would also permit the purchase of the student package from Boyd and Fraser at the reduced rate). For further information on the Course by Newspaper, on how to get your local newspaper to offer the series, or the booklet version, write to: Courses by Newspaper, University Extension, University of California-San Diego, X-002, La Jolla, CA 92093 -- (714) 452-3405.

It should also be noted that subsequent to the original showing of the television series, *Connections* will be available on cassettes or 16mm film for those wishing to purchase a permanent copy. The entire series is available for purchase in 16mm for $6,000 (each 52-minute program is on two reels) and on video-cassette for $3,000. Individual programs may be purchased for $750 each in 16mm or for $375 each in video-cassette. Qualified purchasers may request a preview. Inquiries should be made of Time-Life Multimedia, Room 32-48, Time-Life Building, New York, N.Y. 10020.

The permutations and combinations of available material in this multi-media package are mind boggling and would require a statistical sleuth to unravel. However, the preview-clip of the television series, which I have seen, if at all representative of the whole series, when combined with the print material, of which I have read advance copies, will make any of the combinations worthwhile. While, Mess'ers Burke and Burke, the Holmes and Watson of our story, may not completely solve the mysteries of technological development, they have gathered the clues. Perhaps it is now our role to join them and countless others in the search for answers. Stephen H. Cutcliffe, Editor

"DON'T B^{R}E^{A}K THE ICE" - AN ECOLOGY GAME

A children's game named "Don't B^{r}e^{a}k the Ice" can prove an effective classroom aid in teaching ecology on the high-school or college level. Priced at about $5.00, the game is manufactured by the Schaper Manufacturing Company (9909 South Shore Drive, Minneapolis, Minn. 55441).

The game-board consists of a plastic frame supported horizontally by four legs. Fitted inside the frame are about thirty blocks of white plastic "ice". Two players take turns knocking the blocks out of the frame with the help of small hammers. Steated on one of the blocks is a little plastic "ice man". The player whose hammering causes the block on which the ice man sits to fall out of the frame is the loser. To win a player must use forethought and care.

Though it was not originally intended to serve such a purpose, "Don't B^{r}e^{a}k the Ice" can be a valuable tool in teaching students about the interconnectedness of Nature and the need for man to act responsibly within the natural environment. Playing the game can, in fact, generate excitement and involvement in small or large classes.

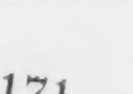
The teacher should explain the game to the class and invite two volunteers to play. The rest of the class can be asked to cheer on their favorites.

After the game has been played and the winner applauded, the teacher should ask the members of the class if they see any correlation between the game-board and Nature. One student may note the interdependency of the pieces. Another may observe that in playing the game the importance of any one piece is hard to estimate. Still another may point out that the ice man (=Man) depends upon the integrity of the ice-blocks (=the ecosystem).

Next, invite the class to define a winning game strategy. ("Hammer lightly!" "Anticipate the consequences of your actions!" "Keep your eye on the whole!") Then invite them to apply this winning game strategy to Nature. (The game-board is analogous to Nature's intricate fabric.)

The class can then be led through some exercises in imagination. First, ask them to imagine a game-board one thousand times as large with only a few players hammering slowly and with blocks replaced as they fall. (Here we have an example of a thinly-populated environment which easily recovers from the demands put upon it.) Next, ask the class to imagine an increase in the number of players and an increase in the size of the hammers, with each player seeing only his small part of the whole and hammering faster than blocks can be replaced. Finally ask the class to imagine a change in the rules of the game which actually gives players points for hammering out and keeping blocks (=the profit motive) with more and more players being added every minute (=unchecked population growth with escalating demands upon world resources).

Wrap up the exercise by pointing out to the class that we are on the game-board. The "game" is our life on this planet. We cannot put the game aside. For our own sakes we must learn to play wisely and well.



Stephen Bertman
Dept. of Classical Studies
University of Windsor
Windsor, Ontario Canada

(This article was originally presented at the STS Curriculum Aids Workshop held at Pennsylvania State University, March 26-27, 1979. Editor)

SHOT SYLLABUS EXCHANGE

Additions to the history of technology syllabus exchange (see Issue #11, pp. 11-13) include the following courses and brief descriptions:

Prof. Avrom A. Blumberg
Head, Division of Natural Sciences and Mathematics
DePaul College, Chicago, IL. 60614

Problems in a Technological Society: Modern Warfare, The Arms Race, Arms Control and Disarmament

A one quarter course which deals with the influence of science and technology on the nature of modern warfare, including the roles played by these specialists in affecting national security and arms control negotiations, and examining the ethical and moral aspects of this activity.

Prof. Derek de Solla Price
History of Science
Yale University, New Haven, CT. 06520

Science, Technology, and Society

A one-semester introductory survey on the relations between society and its evolving science and technology, from the neolithic revolution to the present. (Intended to provide humanities students with an understanding of science and engineering as well as providing students of these latter fields with an understanding of the social context of their work.)

For further information on participating in the syllabus exchange write to: Dr. Stephen H. Cutcliffe, Syllabus Exchange, HPT Program, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015.

ANNOUNCING

(a new annotated bibliography)

The Development of the International Oil Industry

by

Michael Hodges (Lehigh University)

43 p., available from: Vance Bibliographies, Public Administration Series, P.O. Box 229, Monticello, IL 61856. Cost: $4.50.

The 249 books in this bibliography have been chosen "to provide a broad chronological and geographical coverage of the topic; technical treatises and treatments of other energy sources have only been included where they provide necessary background information for an understanding of the evolution of the international oil industry." Subject headings include: General Works; Oil Companies; Oilmen; the Oil Industry in the U.S., Latin America, Western Europe, the Soviet Union and Eastern Europe, the Middle East, Africa, and Asia; Energy Policy and Politics; Oil Industry Technology; the Economic Structure of the Oil Industry; and Alternative Energy Sources and Future Prospects. Annotations are generally brief, 25-50 words in length.

A REVIEW ESSAY

John V. Granger, *Technology and International Relations* (San Francisco: Freeman, 1979), 202pp., paper. $6.50.

To study technological dimensions of international relations is to dwell in a non-field. Each component --technological change, and relations of nations-- is vast, boundless, penetrating all aspects of modern society, and in a constant state of flux. Each springs from the fundamental forces that mobilize and direct the human mind to action. The technological impulse, stimulated and nourished by scientific knowledge, incessantly strives toward men's mastery over their physical environment. And in the relations of nations, the movement starts in the minds of men as an effort to shape and use the international social environment according to their varied sets of values. The two trajectories eventually meet and become fused. However, their interaction and fusion is only one phase in a continuous social process; a study of that phase must necessarily remain open-ended and forever wanting.

A dead giveaway of a non-field is the absence of basic texts surveying the area, mapping out its boundaries, and representing a fundamental agreement on what is in and what is out. There are no such texts for the student of international technology affairs --certainly not in English nor in the major European languages.

That does not mean that there is no literature on the subject. On the contrary, there is a mass of writing, but it is an amorphous mass and to categorize the material is difficult. One possible group includes comprehensive treatments of the progress and implications of technological civilization; the contributors are primarily political scientists, sociologists, and historians from the West[1] as well as the socialist East.[2] At the next level are numerous studies with greater disciplinary and often national specificity; U.S. political scientists predominate.[3] Below this level, the volume of literature and its diversity increase so rapidly that it is impractical even to cite illustrative examples; the range is as broad as the range of technologies, and the geographic scope encompasses the developed world, the oceans, outer space, significant portions of the developing world, and their various combinations. Further down, materials branch out in all directions and roughly fall into at least three sizeable and growing sets of studies: case examinations such as those of the EURATOM (Europen Atomic Energy Community) experience, of Intelsat (International Satellite Corporation), or of the green revolution; issues-oriented writings approaching international technological problems from the perspectives of the environment, energy, or nuclear proliferation; and finally studies of social and socio-economic processes such as technology transfer or the brain drain in technical fields.

John Granger's volume will hardly play a starring role in this expanding field of literature. In fact, it may sit on the shelves unnoticed by many --and if so, it will be a pity. Dr. Granger's training and experience --a communications engineer and physicist, diplomat and journalist, government official and chief executive of a high-technology multinational firm-- leave their imprint on the book. It is policy-oriented and written from the perspective of the advanced countries. Yet it is broadly based in its treatment of concepts and relationships. It surveys the connections of technological change with public policy; with trade and multinational enterprises; with national security, development, and sovereignty; and with energy and resources. *Technology and International Relations* does not really fall into any of the categories suggested earlier --and this is its advantage. Dr. Granger surveys the complex relationship between industry and government and between national and international policies in technology-related affairs. He does so competently and, although the American perspective pervades the entire text, he displays considerable sensitivity to other points of view. For those with a reasonable level of knowledge and understanding about the interface of technology and world affairs, Dr. Granger's book contains little new. But it is a very useful introductory tool, eminently suitable as initial reading for science-society, college courses as well as for courses in international relations. One would wish to see a more adequate bibliography than that randomly supplied through notes at the end of chapters, but this is a relatively marginal problem.

--Zdenek Slouka
Dept. of International Relations
Lehigh University

Footnotes

[1] E.g., Raymond Aron et al., *World Technology and Human Destiny.* Ann Arbor: University of Michigan Press, 1963. - Zbigniew Brzezinski, *Between Two Ages: America's Role in the Technetronic Era.* New York: Viking, 1970. - Daniel Bell, *The Coming of Post-Industrial Society: A Venture in Social Forecasting.* New York: Basic Books, 1973.

[2] E.g., Silviu Brucan, *The Dissolution of Power; A Sociology of International Relations and Politics.* New York: Knopf, 1971. - Randovan Richta, *Civilization at the Crossroads: Social and Human Implications of the Scientific and Technological Revolution.* Prague: International Arts and Sciences Press, 1969. - *Man, Science, Technology: A Marxist Analysis of the Scientific-Technological Revolution.* Moscow-Prague: Academia Prague, 1973.

[3] E.g., Eugene B. Skolnikoff, *Science, Technology, and American Foreign Policy.* Cambridge: M.I.T., 1967. - Skolnikoff, *The International Imperatives of Technology: Technological Development and the International Political System.* Berkeley: University of California, 1972. - Henry R. Nau, *National Politics and International Technology.* Baltimore: Johns Hopkins University Press, 1974. - Harry G. Johnson, *Technology and Economic Interdependence.* New York: St. Martin's Press, 1975. - Victor Basiuk, *Technology, World Politics, and American Policy.* New York: Columbia University Press, 1977.

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BROOKS, HARVEY. "TECHNOLOGY; HOPE OR CATASTROPHE?" TECHNOLOGY IN SOCIETY 1 (SPRING 1979): 3-18.

In the past decade, technological pessimism has spread from humanist ranks to those of scientists. Critical of deeply pessimistic thinkers and skeptical about the logic of alternative technology, Brooks offers a model for the future that is "relatively-optimistic." The persistence of recent problems is attributed partly to societal whims and fancies that have resulted in a failure to achieve difficult solutions. The food, environmental, and energy "crises" have attracted intense but only very brief public notice.

BUNGE, MARIO. "THE FIVE BUDS OF TECHNOPHILOSOPHY. TECHNOLOGY IN SOCIETY."1(SPRING 1979): 67-74.

Technophilosophy is called an "immature and undeveloped branch of scholarship," at the present time comprised mostly of "romantic wailings." Bunge outlines what he sees as the five main research areas for technophilosophy: techno-epistemology or technognosiology (the philosophical study of technology); technometaphysics (ontology of technology); technoaxiology (philosophical study of valuations performed by technologists); technoethics (study of the moral issues encountered by technologists); and technopraxiology (philosophical study of human action guided by technology).

EBEL, ROLAND H.; WAGONER, WILLIAM; AND HRUBECKY, HENRY F. "GET READY FOR THE L-BOMB: A PRELIMINARY SOCIAL ASSESSMENT OF LONGEVITY TECHNOLOGY." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 13 (FEBRUARY 1979): 131-48.

The societal impacts in the United States of the "retardation of the cellular aging process in men and women" are considered. Recent biomedical and genetic technologies indicate the life span may be considerably expanded. The impacts of employment, income, resource consumption, education, social institutions, and legal problems are analyzed for life spans in ten year segments up to an age limit of 110. Demographic and econometric computer models are utilized.

FREEMAN, CHRISTOPHER, AND JAHODA, MARIE, EDS. WORLD FUTURES; THE GREAT DEBATE. NEW YORK: UNIVERSE BOOKS, 1978. VII, 416P. BIBLIOG.

A collection of lengthy essays opens with a survey of the global futures debate and the growth of methods in futures studies during the period 1965-1976. Four crucial issues--food, energy, resources, and technical change--are reexamined in the light of recent writings in economics and the social sciences. From this perusal emerges four possible profiles of the world of the near future. Variations in profiles are keyed to two variables--level of international equality and level of growth. Contributors include Sam Cole, Pauline K. Marstrand, Ian Miles, and Keith Pavitt.

GEORGESCU-ROEGEN, NICHOLAS. "ENERGY ANALYSIS AND ECONOMIC VALUATION." SOUTHERN ECONOMIC JOURNAL 45 (APRIL 1979): 1023-58.

The "energetic" dogma which argues that energy is the "only necessary support of the economic system" is refuted in a rather technical article that is largely readable for the non-initiate in econometrics. The author explains the inconsistencies of a theory which fails to consider matter in terms other than energy, and explains where energy analysis as the basis for economic valuation "goes wrong." He then applies his findings to an investigation of the use of solar radiation. He concludes that such technology is not viable because it is a "parasite" of current technologies that are based on other sources of energy. A thorough "reorientation of our present approach to technology assessment" is demanded.

HAVID, ALAN, ED. "RADIO, IN-DEPTH." JOURNAL OF POPULAR CULTURE 12 (FALL 1978): 217-367.

Thirteen articles focus on the hey-day of radio as popular entertainment. Following a survey of radio as a field of study, contributors look at specific programs and performers including Vic and Sade, Amos and Andy, Fred Allen, Henry Morgan, and Boake Carter; use of the medium for propaganda; censorship; daytime programming for the homemaker; women radio pioneers, and radio drama. A concluding article lists sources for obtaining old programs. It is necessary to note that the date "Fall 1979" has been misprinted on this issue.

"IN VITRO FERTILIZATION: FOUR COMMENTARIES." HASTINGS CENTER REPORT 8 (OCTOBER 1978): 7-14.

In response to the debate occasioned by the birth of Louise Brown, four experts in medical ethics consider the issues. Paul Ramsey weighs the risks of manufacturing our offspring, while the ethical objections to in vitro fertilization are voiced by Stephen Toulmin. Marc Lappe gives attention to the vulnerability of the subjects of experimentation, and John A. Roberts looks at the risks of such fertilization procedures for the fetus.

KARDESTUNCER, HAYRETTIN, ED. SOCIAL CONSEQUENCES OF ENGINEERING. SAN FRANCISCO: BOYD AND FRASER, 1979, XII, 290P. BIBLIOG.

Intended for non-engineering students and others interested in technological problems, this book provides an overview of problems and developments in food, shelter, energy and transport, pollution, communications, biomedical technology, genetic engineering, and control of technology. The editor avers that the book "not only offers an engineering culture to liberal arts students, but invites them to help out engineers in finding the best solutions." Contributors are mainly prominent scientists and technologists. Each section concludes with a bibliography.

LIPSCOMBE, JOAN, AND WILLIAMS, BILL. ARE SCIENCE AND TECHNOLOGY NEUTRAL? LONDON: BUTTERWORTHS, 1979. 60P. BIBLIOG.

The authors do not attempt to define science, technology, or neutrality for fear of narrowing the field of inquiry and because, in practice, the words are used somewhat vaguely. They offer a selection of viewpoints to help the reader formulate his or her own opinion, first, about science --as a body of knowledge, in terms of its aims and methodology, and in terms of scientific activity itself-- and then about technology, at least as far as it may be described as "the direct application of science." This latter terminology may cause some confusion, for the relationship between science and technology, as Lipscombe and Williams admit, is complex. However, this is as far as they take the discussion, which is something of a disappointment. A third section of the book uses current developments in appropriate technology in the Third World as an illustrative example of the issues and positions exemplified previously. They conclude that AT is not neutral.

NELSON, JOHN R., JR. "ALEXANDER HAMILTON AND AMERICAN MANUFACTURING: A REEXAMINATION.: THE JOURNAL OF AMERICAN HISTORY. 55 (MARCH 1979): 971-95.

Nelson examines Hamilton's role as a premier advocate of American manufacturing, concluding that, despite certain platitudes to the contrary, he was generally unresponsive to domestic manufacturers. Revealing of the politics and financial background surrounding the early development of American industrialization.

REISER, STANLEY JOEL. MEDICINE AND THE REIGN OF TECHNOLOGY. NEW YORK: CAMBRIDGE UNIVERSITY PRESS, 1978. XI, 317P. ILL., BIBLIOG.

Reiser describes many of the technological advances of the past four centuries which have not only altered the practice of medicine but also changed the physician/patient relationship. "Objective" evidence has replaced the "subjective" evidence of the patient's sensations and the physician's observations in diagnostic judgements. Emphasis is on American and British developments including: The microscope, stethoscope, thermometer, increasing knowledge of bacteriology and biological medicine, X-ray devices, electrocardiographs, and computers.

STANLEY, MANFRED. THE TECHNOLOGICAL CONSCIENCE. NEW YORK: FREE PRESS, 1978, XIX, 281P. BIBLIOG.

Though Stanley states that he writes "out of a conviction that a literature is now in order eschewing apocalyptic frenzies of doom or salvation in favor of calmer analysis," he admits that the pessimistic case holds more appeal for him. The concept of "technicism", as employed by Stanley, broadly embraces the misuse of scientific and technological modes of reasoning. But his particular concern is with linguistic technicism, defined as the "misuse of scientific and technological vocabularies with regard to human activities," including metaphor and imagery. The book is in three parts. The first follows the historical evolution of technicism, noting particularly successive challenges to human dignity. Part Two studies the linguistic and metaphorical excesses of technicism. The final part turns to the implications of the countertechnicist position for education.

WENK, EDWARD, JR. "POLITICAL LIMITS IN STEERING TECHNOLOGY: PATHOLOGIES OF THE SHORT RUN." TECHNOLOGY IN SOCIETY 1(SPRING 1979): 27-36.

A commitment to the "quick fix" has marred political efforts to steer technology. This "pathology of the short run" is traced to a number of causes, including the exigencies of political expediency, the uncertainty and complexity of technological decisions, bureaucratic resistance to changes, and a tendency to risk avoidance. New institutions created to infuse a more long-range perspective, such as the Office of Technology Assessment, have met with only limited success. Wenk warns that "the benign neglect of the future may undermine even the future capacity to decide."

WRIGHT, DAVID E., AND SNOW, ROBERT E. "LAS VEGAS: METAPHYSICS IN THE TECHNOLOGICAL SOCIETY." CENTENNIAL REVIEW 23 (WINTER 1979): 40-61.

As in the case of the Egyptian Pyraminds or Chartres, the money, energy, and technological know-how of American society has been marshalled for the building of Las Vegas--a shrine to our dominant metaphysic of technological/secular progress. Las Vegas has been successful because it provides a release from the pressures of technological society while it, paradoxically, affirms technological values. The authors review the history of the city with its development related to railroads and Hoover Dam, then explore its present inability to fulfill imaginative needs as it once did. Its allure has been "mechanized extrication from our lock-step world to a land of luxury, release and celebration." But, increasingly, it is becoming an ambivalent symbol of isolation, thoughtless demands on resources, and blind adherence to faith in the technological fix. Another superb thought-inspiring study by this team.

Judith Mistichelli
Christine Roysdon
Lehigh University Libraries

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HUMANITIES PERSPECTIVES ON TECHNOLOGY

Curriculum Newsletter of the Lehigh University HPT Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 13
October 1979

HPT Into STS Goes Once

Lehigh University's Humanities Perspectives on Technology Program is changing its name. Shakespeare and roses notwithstanding, a great deal can lie in a name, and still more in a title whose ingredient words are rich in connotations. Last Spring the teaching faculty in the HPT Program engaged in a two-day intensive examination of the Program's courses and activities, its teaching and its administration, its past, its present, and its immediate future. This effort was the substance of an off-campus retreat that turned out to be enormously productive, especially for the discovery on the part of those participating of how readily constructive criticism could be given and accepted among colleagues who shared a common interest and enthusiasm. One of the specific courses of action that emerged from the retreat was a change in the name of the Program, primarily for three reasons. First, because the existing name suggests an asymmetry in the Program's conduct and character that we have gone to great lengths to avoid, namely, that the Program engages in a humanistic interpretation of technology that is indifferent to active participation by scientists and engineers. As our plans for the near term include extraordinary efforts to increase substantially teaching by faculty from the College of Engineering, it seemed desirable to change the name of the Program to one that expressed the incorporation of technology on equal terms with traditional questions of human value.

Second, the name "Humanities Perspectives on Technology" altogether ignores the involvement of the Program with the study of science as distinct from technology in spite of the fact that a large number of the Program's courses explicitly make just this distinction.

Finally, it has become increasingly common to call the entire field of study that addresses science and technology as cultural phenomena, the science, technology and society field. That our Newsletter is widely acknowledged to be a valuable medium of communication for workers in this field, suggests that it would be a positive step to express our solidarity with the national, and international programming in fact denominated 'science, technology and society' by making that our name as well.

It is nice to have an idiosyncratic name that generates ready identification, but given the *raison d'etre* of the Newsletter, calling it

(continued on p. 15)

Science and Human Values

Although the precise distinction between science and technology is nowhere made to my satisfaction --indeed, I incline to the view that modern science is itself a technology-- it is in some sense intuitively clear that most theoretical scientists and most engineers have very different primary concerns. Thus, a course, however excellent, devoted to examining the role played by value decisions in engineering cannot also, and seamlessly, address itself to the values dimension of scientific theorizing. It was for this reason that these two concerns were kept separate in our lower-level STS offerings, and a course "Science and Human Values" was introduced as a complement to the established "Technology and Human Values" course (see Issue #4, February 1978).

The thesis explored in "Science and Human Values" is that theories of Nature, that is, science and the explicated conceptual frameworks within which scientific theorizing is carried out, implicate theories of human being in the world, that is, conceptions of what it means to be human as reflected in the values and the frameworks of action characteristic of an age. Concurrently, personal and societal value and action frameworks influence the delineation of science's conceptual framework.

In the initial version of this course, classical theories of Nature and their coordinate theories of human nature were presented and contrasted. The first set of examples were drawn from the writings of Plato, Aristotle, Epicurus and Lucretius, and the physics of the Stoics (as described in S. Sambursky's book with that title). This provides a compact and dramatic introduction to the central thesis of the course because here we have four quite distinct theories of nature that were explicitly directed at four distinct interpretations of the human condition, with direct implications for ethical and religious attitudes, that is, for defining the locus of human well-being and of human striving.

Humanities Perspectives on Technology, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of technology, society, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the field of technology studies. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, HPT Program, 216 Maginnes Hall #9, LEHIGH UNIVERSITY, Bethlehem, PA 18015.

We turned next to Medieval and Renaissance amalgams of Christianity and Aristotelean, Platonic, Neoplatonic, and/or Neopythagorean nature philosophy, again by way of excerpts from figures whose concerns included both the theory of nature and the nature of being human: Augustine, Peter Abelard, Aquinas, William of Occam, Nicholas of Cusa, Marsilio Ficino. This time, of course, the particular focus was on how, within the framework of an apparently common Christianity, different conceptions of Christianity could be coordinated with the different interpretations of nature and our knowledge of it that were respectively championed by each of these thinkers.

Using Stephen Mason's *History of the Sciences* and Whitehead's *Science and the Modern World*, the conception of human nature (or the denial of such a nature) implied by the materialistic determinism of Newtonian science was elicited. Also through Whitehead, the students were introduced to the notion that subjectivity was relevant to contemporary physics, raising the question of whether this implied as well that a new theory of human being was in the process of being articulated, one that would "fit" a newly emerging theory of nature. Fritjof Capra's *The Tao of Physics* was used as a means of critically exploring one detailed response to this question, in the process raising challenging questions posed by claims from William Whewell and Claude Bernard to Michael Polanyi and Thomas Kuhn that the practice of science inevitably involves making inferences that cannot be justified empirically. Excerpts from Heinrich Hertz' *Principles of Mechanics*, the writings of Einstein, Piaget, Niels Bohr and Werner

Heisenberg, were used to reinforce the sudden relevance for theoretical physics in the twentieth century of the notions of interpretation and of subjectivity.

The course went over very well the first time through, but there were some student complaints about the Mason and Whitehead texts, and I felt that I had perhaps imposed too historical a framework on the treatment of the course's "message". Thus, on the second time around I changed the format rather drastically without redirecting the emphasis. This time the readings were: Bronowski, *Science and Human Values*; Castaneda, *A Separate Reality;* Capra, *The Tao of Physics;* Israel Scheffler, *Science and Subjectivity;* and Loren Eiseley, *The Firmament of Time.* These were read in the above order. Bronowski argued that there were basal similarities between art and science in spite of appearances to the contrary, for example, both are creative and both concerned with "telling the truth". Castaneda's book was taken as contrasting a philosophy of wisdom based on experiencing the world "as it really is", an experience that transforms the life of the person undergoing the experience, with the philosophy of knowledge characteristic of modern Western culture, in which contact with reality is mediated by elaborate intellectual constructs that do not directly implicate the personal lives of those who work with or know them. Capra argued that in the twentieth century, Western science was recovering the ontological wisdom of Eastern mystical nature philosophy and was for that reason rich with a more accurate account of reality and with new insights into how our lives ought to be shaped by this account.

Scheffler's book was difficult for the majority of the students (who were engineering majors with no previous work in philosophy), offering a subtle, if perhaps tedious, defense of the objectivity of scientific knowledge against the claims of Polanyi and Kuhn among others that it was fundamentally subjective and therefore incapable of grounding a non-arbitrary, community of values. Eiseley's book was taken as making two points: that the concepts employed by scientists at a given time reflect the influence of the time and the place in which they live and that while humanity was a natural product of the planet's development, people did not behave accordingly, thereby threatening humanity's, and the planet's, survival.

This version of the course also received strong student support, and the course is now firmly anchored as one of the requirements for the Technology and Human Values minor. The third time around I would like to join the best features of the two treatments presented here, adding a little more history than the second treatment allowed and diminishing the second treatment's topicality. I would retain the Bronowski book, although I strongly disagree with many of his remarks and consider it dated, because in brief compass it makes some claims about science that science and engineering students seem to find surprising and provocative. I would also retain *The Tao of Physics*, or use the newer *The Dancing Wu Li Masters* which argues a similar position. Because the Eiseley book did not make much of an impression and the Scheffler was very difficult for some students, I would replace both with excerpts of two sorts: one treating the historical materials, as in the first version of the course; the other treating recent issues in philosophy of science touching on the subjectivity of theory construction. (Gerald Holton's *Thematic Origins of Scientific Thought* would perhaps be useful, but it is an expensive paperback, and a long one, which would inhibit additional readings to some extent.)

--Steven L. Goldman
Lehigh University

THE MUSEUM AS PEDAGOGUE

In issue Number 9 (December 1978) of this newsletter, Dr. Patrick Malone, a professor of American Civilization and Director of the Slater Mill Historic Site in Pawtucket, R.I., discussed the important role of technology museums in teaching the history of technology. Further evidence that this view is gaining acceptance was witnessed by the recent formation of the Technology Museums Special Interest Group (TEMSIG) under the auspices of the parent Society for the History of Technology.[1] Recognizing my own lack of familiarity with the pedagogical uses of artifacts and material culture, I decided to make an initial foray into the field and visit several, though by no means all, of the technology-related museums and sites in southern New England. It should be made clear from the beginning that this article is not intended as a museum review such as found in the journal Technology and Culture. On the one hand, I am unqualified for such an endeavor, while on the other hand, comparing a textile museum with an eighteenth-century iron producing facility or sailing museum is like comparing apples, oranges, and guava. Rather, I hope to provide a sense for what can be learned about the history of technology from its artifacts.

During the second week of June a colleague of mine and I expectantly headed north, our first stop being Old Sturbridge Village in central Massachusetts. Childhood memories of Sturbridge as the home of cows and a "little red schoolhouse," quickly dissolved as we entered the grounds of this "living Museum." Although a number of buildings are indigenous to the original town of Sturbridge, most have been transported from other New England sites, in order to create a village milieu including small scale industry and surrounding hill farming as "typically existed" for the period 1790-1840. Here, instead of receiving a guided tour or being overwhelmed by a multitude of descriptive signs and plaques, the visitor enters each building or site and is greeted by a craftsperson or interpreter who describes the particular location and/or what processes and techniques he or she is presently using. Coming as we did primarily to expand our awareness of technological history, handcraft exhibitions such as the shoemaking and cooperage shops held special fascination. Here, admidst the clutter of scrap sole leather and of hand-shaped barrel staves, the visitor watches skilled craftspeople actually practicing their trade while at the same time describing what they are doing technically and how this related to the local or larger regional historical picture. Complementing these crafts and a host of others including broommaking, tin making, pewterware, blacksmithing, dyeing, and weaving are a grist mill and operating woolen carding mill, the latter powered by a horizontal tub water wheel.[2] It is one thing to read about the fairly complex carding machine which replaced traditional hand cards; however, it is quite another thing to actually see such a machine. And, if one is lucky enough to see the machinery in actual operation, the true sense of technological development finally begins to come through.

It should be noted that museums and their collections frequently change and grow, and Sturbridge is no exception. At present tentative plans call for the development of further industrial exhibition sites, including a small textile mill and worker housing, which when combined with the rearrangement of existing sties will provide the flavor of early New England industrial activity as well as the associated town and rural farm life so well portrayed at present.

A second major stop on our self-designed tour was the Merrimack Valley Textile Museum (MVTM) in North Andover, Mass. MVTM's purpose is to preserve both the artifacts and documents relative to the American textile industry, a task in which it succeeds admirably. The artifacts were of primary interest to us and are housed in two public galleries and a large warehouse building in close proximity to the museum proper. This latter building is not open to the public, but special arrangements to view the machinery can generally be made by academic scholars and other serious researchers by writing in advance to museum officials.

Have you ever wondered how a spinning jenny worked, or how large it was even after staring at a diagram for many hours? Or what a flying shuttle really looks like? How many of us really have a sense for not only the strength but also the skill it took to operate a semi-automatic spinning jack without breaking the thread? Watching these machines and many more in actual operation clarified many fuzzy impressions I had of the early woolen textile industry. This clarification is only to be truly gained in museums like MVTM.[3]

A major advantage of a museum like MVTM is the logical arrangement of artifacts designed to show the "process" of textile manufacturing. Hand operations are depicted in one gallery, while the machine process is shown in the other. Dealing here only with the latter, one enters the gallery and is confronted by a wool picker used to break up the larger pieces of wool and extract any extraneous matter such as small sticks. Next, the visitor can watch a double carding machine straighten the woolen fibers into rovings which are then ready for the spinning process. A spinning jenny and spinning jack provide the visual lessons for this stage. The weaving process itself is demonstrated on two power looms. Experiencing the tremendous noise and vibration of just one of these looms in operation made me wonder what it must be like to work in a whole room full. The finishing stages, fulling, raising/teasling, and shearing, of the cloth, are subseqently explicated by machines for each of these respective processes.

Well designed silk-screen panels describe each display, so that if a guided tour us unavailable or there is no interpreter to operate the machinery, one can still get a fairly clear idea of each artifact's operation. However, there is nothing that can truly replace seeing a machine actually running. And when one compares the mechanized stage of production to the hand operation shown in the other gallery, a true understanding of technological development and mechanization finally becomes clear.

Slater Mill Historic Site in Pawtucket, R.I., was the third important stop on our trip. Here in the restored mill originally begun by Samuel Slater in 1793 are exhibits on cotton manufacturing describing both the domestic handcraft process and the subsequent change to machine production. A learning experience similar to that described above is available here, the primary change being in the cotton fiber which entails a somewhat different set of machinery. The sense of process, the understanding of mechanization, and a feel for machinery in operation is virtually the same however.

Almost unique to the Slater Site though is the reconstruction of a late nineteenth-century, textile mill machine shop housed in the adjacent Wilkinson Mill. As one enters the second floor shop he or she is immediately transported back in time a century or more. Here are grinders, the universal milling machine so important to the machine tool industry, and various other metal and woodworking machines. The smell of oil and the rhythmic slap of leather belting driving these machines, most of which are operable, gives the sense of what it was like to work in such a shop.

A tight time schedule forced us to tear ourselves away from this fantastic exhibit, for on a trip of this nature, one can only see and do just so much. In addition to these major stops, we also visited the Saugus Iron Works in Saugus, Mass., Mystic Seaport in Mystic, Conn., Newport, R.I. and a host of other individual mills and worker housing, some restored and some which have been continuously lived in since the eighteenth and nineteenth centuries.

There is neither space, nor is it my intent, to catalogue further the places we visited on our trip or to suggest that someone else follow directly in our steps. Rather, my purpose has been to try to suggest the value of museums and other technological sites for the historian of technology. Independent of the obvious research value of such sites and collections to which I have only alluded is the pedagogical value they hold for the teacher, no matter what level one is talking about. While a grammar school teacher from California or a college professor from Iowa are unlikely to be able to take their classes to Slater Mill Historic Site, a personal visit there or to similar sites is by no means out of the question. Such an experience can only add to one's understanding and, therefore, classroom presentation. Beyond this though, it is my hope that individuals might be inspired to look around their own communities for area museums or industrial sites that can reveal something of the process of technological change. No one can reasonably expect to take even a class of graduate students to all or even the most important museums, let alone industrial sites; however, one or two brief exposures to the physical being of technology will help clarify the workings of machines and open the eyes to what Eugene Ferguson has called the "nonverbal" aspects of technology.[4]

One final comment, although seemingly obvious, is perhaps in order, at least as based upon my conversations with museum personnel who have a sincere interest in education and seeing that it is carried out most effectively.[5] Clearly a major purpose of museums is to instruct and educate, not merely to house artifacts. (Old Sturbridge, for example, maintains a special orientation building used to introduce school children to some of the exhibits they will encounter on the main grounds by exposing them to a "hands-on" experience with reproductions of many of the artifacts and with various craft processes.) However, to walk in unannounced and expect an appropriate tour is not merely discourteous but frequently much less rewarding educationally. Imagine the consternation on a director's face when he or she discovers that the afternoon's tour is not to be given to a group of grade schoolers, but rather to a class of aspiring graduate students in the history of technology. The preparation by interpreters must vary widely in such obvious cases. Instructors would do well to meet with museum officials in advance of any class visit, no matter what level of student is involved. In this manner, everyone knows what to expect. Extra interpreters or specialists in a particular area of interest can then be brought in if necessary, and the instructor can prepare his or her class in advance for what to expect. With these few warning suggestions aside, I can only echo Professor Malone and say, "Get thee and thy students to a museum."

--Stephen H. Cutcliffe
Lehigh University

FOOTNOTES

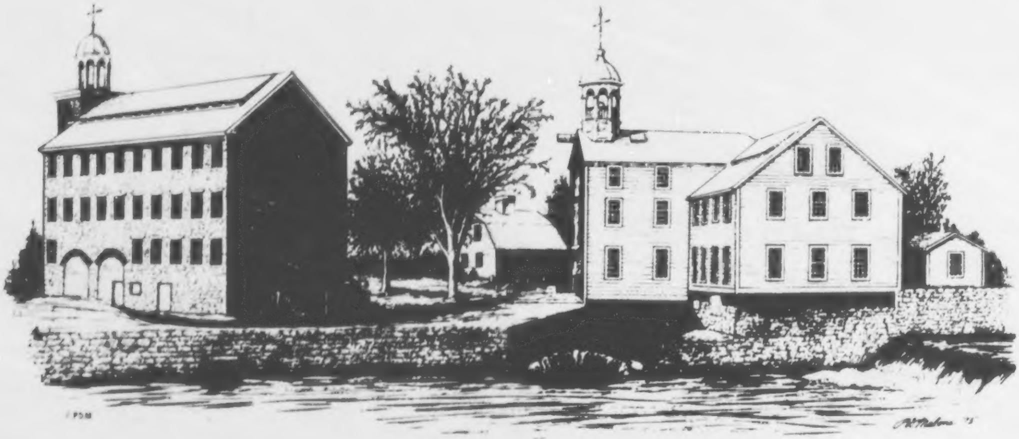
[1] For further information on TEMSIG, one should write to: Mr. Theodore Z. Penn, Research Dept., Old Sturbridge Village, Sturbridge, Mass. 01566.

[2] Carding is the necessary process by which textile fibers are straightened before yarn spinning can take place.

[3] A good description of several North American textile museums including Watkins Mill State Park (Lawson, Mo.); Upper Canada Village (Morrisburg, Ontario); Henry Ford Museum and Greenfield Village (Dearborn, Mich.); Slater Mill Historic Site (Pawtucket, R.I.); and Little Red Shop (Hopedale, Mass.) is contained in James C. Hippen, "Industrial Textile Machinery: Five North American Museums," Technology and Culture 10(October 1969): 570-86. An updated museum review of the Slater Mill Historic Site is scheduled to appear in a forthcoming issue of Technology and Culture. For a review of the MVTM see Thomas W. Leavit, "The Merrimack Valley Textile Museum," Ibid. 8(April 1967): 204-6.

[4] Eugene Ferguson, "The Mind's Eye: Nonverbal Thought in Technology," Science 197 (26 August 1977): 827-36.

[5] While many people helped to make our trip rewarding and enjoyable, I would particularly like to thank Patrick Malone, Slater Mill Historic Site; Laurence Gross, Merrimack Valley Textile Museum; and Theodore Penn, Old Sturbridge Village, for their assistance in the preparation of this article and their gracious hospitality while visiting each of these locations.



Pen and ink sketch courtesy of Slater Mill Historic Site

SCIENCE FICTION ODDS AND ENDS

For a long time it seemed that almost everything written on science fiction either defined or defended it. Now, however, science fiction has gained a measure of acceptance, and we are getting the broader kind of study which is especially helpful and practical to the new teacher in the field. Let me call your attention to the overviews of individual authors in Thomas D. Clareson's *Voices For The Future* (Bowling Green University Popular Press, Bowling Green, Ohio 43403). Volume I contains essays on Jack Williamson, Olaf Stapledon, Clifford D. Simak, Isaac Asimov, Robert A. Heinlein, Theodore Sturgeon, Ray Bradbury, Henry Kuttner, C.L. Moore, Arthur C. Clarke, and Kurt Vonnegut. Volume II, just out, contains essays on Robert Silverberg, Philip Jose Farmer, Walter M. Miller, Jr., J.G. Ballard, John Brunner, Mack Reynolds, Ursula K. Leguin, and Roger Zelayny.

I've been not-so-secretly lusting after a *Star Trek* course lately, and thus I was quite pleased to discover that National Film & Video Center (Suite 200, 1425 Liberty Road, Eldersburg, Md. 21784) has 10 episodes for sale or rent: "The City on the Edge of Forever" (time travel), "Amok Time" (Spock's mating urge), "Catspaw" (space witches), the 2 part "Menazerie" (a cerebral race), "Shore Leave" (a space age amusement park), "Space Seed" (genetic supermen in suspended animation), "The Squire of Gothos" (a fierce Eighteenth Century squire in space), "The Trouble With Tribbles" (lovable little furry animals who live to reproduce), and "Miri" (a race of children who die at puberty). At this writing, rental is $59 (4 for $199) and sale price is $399. Call Laura Murphy for rentals, B.J. Quensinberry for purchases (301-795-3000).

I'm also impressed with the quality of John Hollow's lectures on specific science fiction writers and works available on audio-cassette from Everett Edwards, Inc., Box 1060, Deland, Fl. 32720, at $9.95 each. Now available are tapes on Isaac Asimov (*I, Robot* and *The Foundation Trilogy*), Ray Bradbury (*Martian Chronicles* and *Illustrated Man*), Edgar Rice Burroughs (first 3 novels of the John Carter series), Mary Shelley (*Frankenstein*), Jules Verne (*Journey to the Center of the Earth*, *From the Earth to the Moon*, *20,000 Leagues Under the Sea*), and H.G. Wells (*Time Machine* and *War of the Worlds*).

Prof. Thomas P. Dunn, Dept. of English, Miami University, Hamilton, Ohio 45011 has a useful "selected, Annotated List of Works Incorporating the Themes of Hives and Mechanization," a subject similar to the "cocoon dystopias" I talked about last issue. Prof. Dunn will send you a copy if you will enclose a self-addressed, stamped envelope. Prof. Dunn and his colleague Prof. Richard D. Erlich are also recruiting essays relating to this topic (computer tyrannies, hive environments, bionics, cybernetics, brain-recording, etc.) for a volume entitled *People and Machines in Science Fiction*, and they would be pleased to hear from possible contributors.

Help! Last Spring I became interested in the image of the scientist, particularly, but not only, in popular culture, and I didn't find too much in the way of critical material to help me. There's George Basalla, "Pop Science: The Depiction of Science in Popular Culture," in G. Holton and W.A. Blanpied, *Science and Its Public* (New York: D. Reidel, 1976); Milton Millhauser, "Dr. Newton and Mr. Hyde: Scientists in Fiction from Swift to Stevenson," *Nineteenth Century Fiction*, 28(1973), 287-304; Laura Crouch, "The Scientist in English Literature: From Domingo Gonsales (1638) to Victor Frankenstein (1817)," *Dissertation Abstracts International*, 36(1975), 2181A; and Thomas D. Clareson, "The Scientist as Hero in American Science Fiction, 1880-1915," *Extrapolation*, 7(1965), 18-28. From Basalla I had a happy excursion into *Star Trek*'s Dr. Spock and such Marvel comics as "The Fantastic Four," "The Incredible Hulk," and "The Amazing Spider Man." But what else is there? I'd appreciate any and all contributions to a bibliography on the image of the scientist.

--Edward J. Gallagher
Lehigh University

Course Syllabi

TECHNOLOGY AND MATERIAL CULTURE IN AMERICA, 1600-1860

American Civilization 152

Prof. Patrick Malone
American Civilization Program
Brown University

1. INTRODUCTION/CONCEPTS OF MATERIAL CULTURE.
Suggested: James Deetz, *Invitation to Archaeology.*

2a. HISTORICAL ARCHAEOLOGY.
James Deetz, *In Small Things Forgotten.* Suggested: *Invitation to Archaeology.*

2b. TECHNOLOGY AND CULTURAL CHANGE: NEW ENGLAND INDIANS.
Daniel Gookin, "Historical Collections of the Indians in New England" in *Collections of the Mass. Hist. Soc.*, I.
Suggested: Patrick Malone, "Changing Military Technology Among the Indians of Southern New England, 1600-1677," in *Am. Qtrly.*, March, 1973.

3. EARLY AMERICAN MANUFACTURING.
Brooke Hindle, ed., *America's Wooden Age*, pp. 29-80, 110-114, 120-159.
Arthur C. Bining, *Pennsylvania Iron Manufacture in the Eighteenth Century.*
Suggested: Edwin Tunis, *Colonial Craftsmen.*

4. ARCHITECTURE AND BUILDING TECHNOLOGY IN THE 17th CENTURY.
Hindle, ed., *America's Wooden Age*, pp. 13-29.
Abbott Cummings, *Architecture in Early New England.*
Alan Gowans, *Images of American Living*, pp. 18-28, 46-63, 79-111.
Suggested: Hugh Morrison, *Early American Architecture.*

5. ARCHITECTURE AND BUILDING TECHNOLOGY IN THE 18th CENTURY.
Cummings, *Architecture in Early New England.*
Christopher Tunnard and Henry Reed, *American Skyline*, pp. 32-65.
Harley McKee, *Introduction to Early American Masonry*, pp. 41-53.
Gowans, *Images of American Living*, pp. 29-44, 115-239.
Suggested: William H. Pierson, *American Buildings and Their Architects*, I, *The Colonial and Neoclassical Styles.*

6. ARCHITECTURE AND BUILDING TECHNOLOGY, 1800-1860.
Tunnard and Reed, *American Skyline*, pp. 66-113.
McKee, *Introduction to Early American Masonry*, pp. 9-39.
Gowans, *Images of American Living*, pp. 287-327.
Suggested: Pierson, *American Buildings and Their Architects*, I.

7. WATER AND STEAM POWER.
Patrick Malone, *The Lowell Canal System.* Hindle, ed., *America's Wooden Age*, pp. 160-92.

8. GROWTH OF AMERICAN INDUSTRY AND INDUSTRIAL COMMUNITIES, 1790-1860.
John F. Kasson, *Civilizing the Machine*, chaps. 1-4.
Nathan Appleton, *Introduction of the Power Loom and Origin of Lowell.*
Robert Woodbury, "The 'American System' of Manufacturing," in Edwin Layton, ed., *Technology and Social Change in America.*
Henry R. Hitchcock, *Rhode Island Architecture*, pp. 36-43.

9. SLATER MILL FIELD TRIP.
   Paul Rivard, *Samuel Slater.*
   David Wilkinson, "Reminiscences," in Carroll Pursell, ed., *Readings in Technology and American Life*, pp. 40-49.

10a. INDUSTRIAL ARCHEOLOGY.
   Malone, *The Lowell Canal System.*
   Robert Vogel, *Roebling's Delaware and Hudson Canal Aqueducts.*

10b. ADAPTIVE REUSE OF HISTORIC STRUCTURES.
   Walter Kidney, *Working Places*, pp. 20-24, 30-33, 64-66, 81-85.
   Tony Wrenn & Elizabeth Mulloy, *America's Forgotten Architecture*, pp. 231-289.

11. TRANSPORTATION.
   Mark Twain, *Life on the Mississippi*, chaps. I-XXX, XXXVIII.
   George Taylor, *The Transportation Revolution*, chaps. II-VII.

12. BRIDGE DESIGN.
   Richard Allen, *Covered Bridges of the Northeast*, chaps. I-IV.
   David Plowden, *Bridges, The Spans of North America*, pp. 9-24.

13a. BRIDGE DESIGN/CONCLUSION.
   Plowden, *Bridges*, pp. 71-117.
   Vogel, *Roebling's Delaware and Hudson Canal Aqueducts.*

13b- READING PERIOD
14. Wrenn & Mulloy, *America's Forgotten Architecture.*

TECHNOLOGY AND MATERIAL CULTURE IN AMERICA - 1860 TO THE PRESENT

American Civilization 153 — Prof. Patrick Malone

1. INTRODUCTION/HISTORICAL BACKGROUND.
   Suggested: James Deetz, *In Small Things Forgotten.*

2. INNOVATION AND THE "SYSTEMS APPROACH" TO TECHNOLOGY.
   Elting Morrison, *Men, Machines, and Modern Times.* chaps. 1, 2, 6, 7.
   Robert M. Pirsig, *Zen and the Art of Motorcycle Maintenance*, pp. 90-95.
   Suggested: Harold Passer, *The Electrical Manufacturers.*

3. ARCHITECTURE AND BUILDING TECHNOLOGY, 1860 - PRESENT.
   Christopher Tunnard and Henry Reed, *American Skyline*, pp. 90-210.
   Weismann, "A New View of Skyscraper History." In H. R. Hitchcock, et al., *The Rise of an American Architecture.*
   Suggested: William Jordy, *American Building and Their Architects: Progressive and Academic Ideals at the Turn of The Twentieth Century*, chap. 1.
   Suggested: John Poppeliers, et al., *What Style Is It?*

4a. MATERIAL FOLK CULTURE AND TECHNOLOGY.
Henry Glassie, *Pattern in the Material Folk Culture of the Eastern United States.*

4b. ARCHITECTURE, INTERIOR DESIGN, AND CRAFTSMANSHIP.
Vincent Scully, Jr., *Frank Lloyd Wright.*

5. THE DEVELOPMENT OF A METROPOLIS: BOSTON.
Sam B. Warner, *Streetcar Suburbs.* Suggested: *Boston Architecture.*

6. BRIDGE DESIGN.
David McCullough, *The Great Bridge.*
David Jacobs, *Bridges, Canals, and Tunnels*, pp. 136-141.
T. Allen Comp and Donald Jackson, *Bridge Truss Types.*
Suggested: David Plowden, *Bridges: The Spans of North America.*

7a. CIVIL ENGINEERING ON THE GRAND SCALE: THE PANAMA CANAL.
David McCullough, *The Path Between the Seas.*

7b. THE LITERARY RESPONSE TO INDUSTRIALISM.
Mark Twain, *A Connecticut Yankee in King Arthur's Court.*
Suggested: Herman Melville, "A Tartarus of Maids."

8a. TECHNOLOGY ON THE GREAT PLAINS.
Walter P. Webb, *The Great Plains*, chaps. 7-8.
Siegfried Giedion, *Mechanization Takes Command*, pp. 130-168.

8b. BOOM TOWNS AND PRECIOUS METALS.
Rodman Paul, *Mining Frontiers on the Far West.*
John McPhee, *Coming into the Country*, pp. 220-228.
Suggested: *Otis Young, Western Mining.*

9. COAL MINING.
Harry Caudill, *Night Comes to the Cumberlands.*
Suggested: Keith Dix, *Work Relations in the Coal Industry.*
Suggested: Kai Erikson, *Everything in its Path.*

10a. THE ASSEMBLY LINE.
Giedion, *Mechanization Takes Command*, pp. 77-126.
Suggested: Eli Chinoy, *Automobile Workers and the American Dream.*

10b. Movie: *Modern Times.*

11. THE AUTOMOBILE AND AMERICAN CULTURE.
James Flink, *The Car Culture.*
Tom Wolfe, *Kandy-Kolored Tangerine-Flake Streamline Baby*, chaps. 2,6,8.

12. TOUR OF AN AUTOMOBILE ASSEMBLY PLANT.
Harvey Swados, *On The Line.*

13a. CONCLUSION.

13b- READING PERIOD.
14. David Plowden, *The Hand of Man on America.*

SHOT SYLLABUS EXCHANGE

Additions to the history of technology syllabus exchange (see Issues #11, pp. 11-13 and #12, p. 16) include the following courses and brief descriptions:

Prof. Roger E. Simon
Dept. of History
Lehigh University, Bethlehem, PA 18015

The Machine in America

A one semester survey of American technology and societal interactions. In addition to general trends the course examines in depth three technologies: 1) textiles and shoes, 2) iron and steel, and 3) the automobile and assembly line. Lecture.

Prof. Patrick Malone
American Civilization Program
Brown University, Providence, R.I.

Technology and Material Culture in America; 1600-1860 and 1860 To The Present

A two-semester interdisciplinary course covering the broad range of material culture including architecture and building. Non-freshman level.

The actual exchange works as follows:

1. Individuals desirous of obtaining a particular syllabus should write directly to the appropriate instructor enclosing a copy of their own course material and a long stamped, self-addressed envelope.
2. Individuals desirous of obtaining more than one syllabus to a maximum of five (each semester counts as one syllabus) or those without material to exchange should write to the address below requesting the appropriate information. A small fee of $1.00 will be charged to cover duplication and mailing costs in this situation.

If you are interested in participating in the syllabus exchange write to:

Dr. Stephen H. Cutcliffe, Administrative Assistant, STS Program, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015. (Please include a copy of available syllabi - updated listings will be included in subsequent issues.)

OPEN FORUM

Another addition to the list of active scholars who would be willing to visit campuses for lectures, colloquia, etc. and his topics includes:

Dr. Carl Mitcham
St. Catharine College
St. Catharine, Kentucky 40061

"Philosophy of Technology: Origins and Issues"
"The Greek Understanding of Technology"
"The Engineering Idea of Technology"

A Seminar Announcement

The Seventh Annual Meeting of the Joint Atlantic Seminar in the History of the Physical Sciences will be held at the University of Maryland, College Park; the tentative date is April 18 - 19, 1980. The major theme of the meeting will be Interactions of the History and Philosophy of Science.

To receive further information, send a self-addressed envelope to: Stephen G. Brush, History Department, University of Maryland, College Park, MD 20742.

Appropriate Technology Curriculum Workshop

On October 25, 1979 the Agency for International Development (AID) and the National Association for Foreign Student Affairs (NAFSA) will sponsor a day-long workshop on teaching appropriate technology at the graduate level in Wilmington, Delaware. The primary purpose of the workshop is to examine ways in which appropriate technology can be included in graduate programs in engineering, business management, science, and agriculture. Such interchange should help to stimulate new and dynamic approaches useful to students from developing countries.

The conference is open to those involved with curriculum planning especially from, but not limited to, schools with AID sponsored graduate students. If you are interested in attending the conference or want further details please contact: Rosemary Walker, Co-Chairperson of Workshop, Special AID/NAFSA Projects Coordinator for Region IX, R.D. #3, Box 537, Lewisburg, PA 17837.

A Brief Reminder

We still have a limited number of copies left of:

BEYOND TECHNICS: HUMANISTIC INTERACTIONS WITH TECHNOLOGY. A BASIC COLLECTION GUIDE by Judith Mistichelli and Christine Roysdon. Humanities Perspectives on Technology, Lehigh University, 1978.

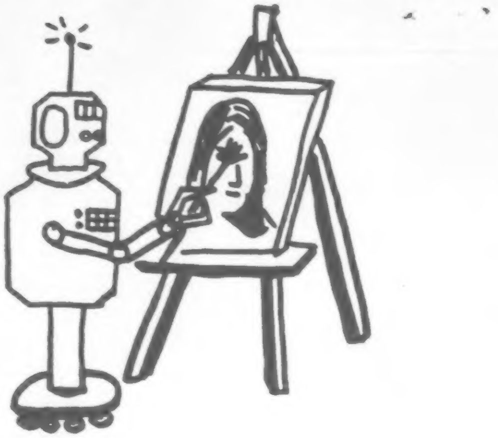
Highly annotated guide to the 100+ books which provide the most significant statements resulting from considerations of technology from humanistic points of view. The bibliography attempts to provide the researcher, teacher, or student new to this interdisciplinary field with a basis both for an understanding of treatments of the issues to date and for an investigation of the relevant scholarship. Overviews, anthologies, historical and case studies are selected, plus interactive studies of technology with art, literary criticism, fiction, science fiction, poetry, social impact, technology assessment, philosophy and ethics. Major interdisciplinary journals are also described. Works included span from Charles Dickens' *Hard Times* (1854) to Langdon Winner's *Autonomous Technology* (1977). Useful for researchers, as a supplement to assigned texts in classes, and to librarians. $2.00. Soft-bound, 6x9 format, 63 pages.

A THOUSAND THOUGHTS ON TECHNOLOGY AND HUMAN VALUES. by Edward J. Gallagher. Humanities Perspectives on Technology, Lehigh University, 1979.

This book (a cross between *Bartlett's Quotations*, Pascal's *Pensees*, and a Book of Meditations) strives to stimulate thought and discussion about technology/human values issues through 1000 quotes (ranging in length from a sentence to a short paragraph). It includes thoughts by such people as Jacques Ellul,, Aldous Huxley, Lewis Mumford, Robert Pirsig, , Charles Reich, Theodore Roszak, E. F. Schumacher, Dostoevsky, Hawthorne, Paolo Soleri, Janis Joplin, Bob Dylan, Isaac Asimov, Ambrose Bierce, Studs Terkel, Kenneth Boulding, Barry Commoner, Jacob Bronowski, Karl Marx, Marshall McLuhan; and from such works as the Bible, *Star Trek*, "John Henry," and *The Invasion of the Body Snatchers*.

It is designed to serve as a reference work for college and high school teachers, and as a supplementary text for college and high school students, in a wide variety of Science, Technology, and Society courses. Specifically, as a vivid record of the major ideas and authors in the STS field, it can help structure class lectures, spur class discussions, provide paper topics, formulate essay exam questions, and enliven audio-visual presentations and newsletters. $3.00. Soft-Bound, 6x9 format, 100 pages.

Order Either Book from: STS Program, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015. Make checks payable to Lehigh University.



M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

HAZELON, D. L. "RISK AND RESPONSIBILITY." SCIENCE 205 (20 JULY 1979): 277-80.

An increasingly wary public who perceives an apparently unmanageable growth of scientific knowledge and technological applications has clamored for --and won-- a more open decision-making process for innovations that involve risk. At the same time, those judicial and legislative officials who are entrusted with an ever larger role in such decisions lack the technical background to judge effectively, a problem deplored by scientists already critical of apparent over-regulation. Hazelon emphasizes that in risk assessment questions of fact and value are intermingled, complicated as much by scientists' unwillingness to confront hard questions as by the inadequacy of public knowledge.

BOLTON, KATE. "THE GREAT AWAKENING OF THE NIGHT: LIGHTING AMERICA'S STREETS." LANDSCAPE 23, NO. 3, 1979.

The rapid advances in street lighting around the turn of the century are discussed pointing out their impact on working, entertainment, commercial activity, and urban imagery. Vintage photographs illustrate the variety of lighting techniques. (Abstract contributed by Bonnie Loyd, Managing Editor, Landscape).

BRAUN, ERNEST; COLLINGRIDGE, DAVID; AND HINTON, KATE. ASSESSMENT OF TECHNOLOGICAL DECISIONS-CASE STUDIES. LONDON, BOSTON: BUTTERWORTHS, 1979. 59 P. (SISCON-SCIENCE IN A SOCIAL CONTEXT).

A collection of brief case studies illustrates how decisions about technology are made and how they might be improved. The introduction of a new technology is envisioned as a two-phase process composed of: the decision to attempt an innovation; and the transformation of an invention to an innovation througn marketing. Case histories demonstrate admirably both expected and unforeseen consequences of new technologies, including the SST, DDT, Concorde, Thalidomide, the Aswan High Dam, and the fast breeder reactor. Tersely written and well-organized.

GOWING, MARGARET, AND ARNOLD, LORNA. THE ATOMIC BOMB. LONDON, BOSTON: BUTTERWORTHS, 1979. 56 P. (SISCON-SCIENCE IN A SOCIAL CONTEXT).

Concentrating on the crucial years 1939-63, the authors retrace the discovery of atomic fusion and the development of the bomb. Questions concerning the responsibilities of scientists, issues in arms limitations, and the "necessity" of Hiroshima are reviewed. Unfortunately, dominating the slim volume is a rather unreflective apology for the British role in research that lead to the bomb ("without the British work the Second World War would have almost certainly ended before an atomic bomb was dropped") and a recounting of Britain's anxiety to become the third nuclear power. Appendices of period papers and letters. Not the best of this series.

HIRSCHHORN, LARRY. "POST-INDUSTRIAL LIFE: A U.S. PERSPECTIVE." FUTURES 11 (AUGUST 1979): 287-98.

Recognizing that adulthood is no longer a static plateau in personal identity, Hirschhorn looks into the cultural changes which have transformed the adult life stage into a developmental period where flux causes increased anxiety. Causal trends are the loss of the gate-keeping power of educational institutions, less dependence on institutions for access to resources, and the declining costs of breaking job commitments. The author outlines numerous indicators of social development that suggest a more fluid articulation of work and life. The loss of life-scheduling rules formerly provided by family and institutions will cause increased anxiety, migration, divorce, suicide if a new social "scheduling" policy does not fill the gap.

PETERSEN, JAMES C., AND MARKLE, GERALD D. "POLITICS AND SCIENCE IN THE LAETRILE CONTROVERSY." SOCIAL STUDIES OF SCIENCE 9 (MAY 1979): 139-66.

Despite the strong opposition of the AMA, USDA, and the American Cancer Society, proponents of the cancer treatment Laetrile continue to fight for recognition and to win new supporters. Emphasizing areas of disagreement and the role of vlues, the authors review the Laetrile dispute. The movement is found to be not a simple push for the legalization of a drug, but rather an "attempt at paradigm creation and revolutionary science" supported by a "revisionist history of medicine" centered on the efficacy of natural cures. Thus, it is the whole Laetrile "science," not merely its most infamous product, that has been labelled pseudo-science and quackery by its opponents. The authors apply the concept "adjudication" to the understanding of the Laetrile phenomenon, a concept they feel accommodates both knowledge and value factors in decision-making about the drug.

TARR, JOEL A., ED. THE CITY AND TECHNOLOGY. ISSUE TITLE: JOURNAL OF URBAN HISTORY5 (MAY 1979): 275-396.

Essays chosen for this issue are concerned with the roles of four technologies in the urban setting: automobiles, energy systems, sewers, and the paving of streets. The time period covered is from 1880 to 1930 and investigators consider the rationale for technological choices, the "unexpected" impacts of technologies on the quality of urban life, and the reactions of planners and officials to change.

U.S. HOUSE OF REPRESENTATIVES. SCIENCE AND TECHNOLOGY COMMITTEE. AGRICULTURAL AND ENVIRONMENTAL RELATIONSHIPS: ISSUES AND PRIORITIES. 1979. Y4.SCI2:96/J.

The effects of environmental protection regulations on agricultural productivity are examined in this compilation of readings, studies, and statistics prepared by the Congressional Research Service. Analyses cover alternative technologies, air and water pollution, pesticides, sludge, and conservation programs.

U.S. HOUSE OF REPRESENTATIVES. SCIENCE AND TECHNOLOGY COMMITTEE. PRINT. SUBJECTS AND POLICY AREAS FOR THE CONSIDERATION OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY. 1979. 214 P. Y4.SCI2:96/K.

The Congressional Research Service provides concise examinations of the background and importance of more than one hundred issues in science and technology. Included are aging research, new technologies for the handicapped, disposal of hazardous wastes, coal liquefaction and gasification, information management, weather modification, ocean resources, and aircraft noise abatement.

WAGAR, M. WARREN. "THE STEEL-GRAY SAVIOUR: TECHNOCRACY AS UTOPIA AND IDEOLOGY." ALTERNATIVE FUTURES 2 (SPRING 1979): 38-54.

Howard Scott's technocracy movement grew from the belief that technology represented an immense power for good that had been bungled and misunderstood by tradition-bound politicians. According to its advocates, only steel-gray-clad technical experts were equipped to abolish poverty and depression. With roots in the work of Saint-Simon, Comte and nineteenth and early twentieth century utopias, technocracy did not emerge as a popular movement, but grew to be the "most powerful vehicle of social ideas and the most powerful utopian vision of the late modern world." The connotations of technocracy in recent works, however, have been far less benevolent.

WEBER, RONALD. "THE VIEW FROM SPACE: NOTES ON SPACE EXPLORATION AND RECENT WRITING." GEORGIA REVIEW 33 (SUMMER 1979): 280-96.

Space exploration functions as a means of turning attention back to Earth in writings by Buzz Aldrin, Archibald MacLeish, John Updike, W.H. Auden, Saul Bellow, Robert Lipsyte, and Anne Morrow Lindbergh. Surveying works by these authors, Weber finds that the view from space compels a renewed awe in man's nature and the Earth's uniqueness, but it can also serve as an ironic counterpoint to common, empty human life. In contrast, the removal of the mystery of outer space by science has led science fiction writers to the exploration of the inner mysteries of the imagination. Wright Morris' The Fork River Space Project demonstrates the striving for "mystical new beginnings associated with space" but centered in imaginative fantasies.

Judith Mistichelli
Christine Roysdon
Lehigh University Libraries

the "Curriculum Development Newsletter of Lehigh University's Science, Technology and Society Program" simply expresses the way that the Newsletter is in fact taken by its more than 2400 subscribers and at least twice that many readers, who now tacitly set aside its slightly queer title, confident that the content of the Newsletter is not idiosyncratic, reflecting the interests of a program unique to Lehigh. We would hope that the continued reputation of our STS Program would rest on its inherent excellence and not on the curiosity of its title, which I hasten to add, is not given up lightly. Although it "obtrudes on the inner ear" when pronounced, as Max Baym used to say, it has been internalized by those of us for whom the Program entails daily involvement, and so HPT goes into STS, with some misgivings and some trepidation, but also in the hope that it goes in evenly, with nothing left out.

Here and now, at least, changes come in twos. The present Newsletter was originally part of a dissemination grant provided by the National Endowment for the Humanities, whose support had established the HPT/STS Program in the first place. Currently, the publication of the Newsletter and its distribution is a service to the STS community made possible by NEH Education Grants funds scheduled to decrease to the zero support level over the coming year, as discussed in the November 1978 issue of this Newsletter. It was the Endowment's contention that if the Newsletter continues to be as worthwhile as its readership indicated it has been, then the readership should be willing to provide the financial base for its continuation. We are therefore going to have to turn to you for assistance in publishing the Newsletter in its present format, at the rate of six issues a year. We use the word "assistance" advisedly, because we are keying the subscription price that we are forced to charge if we are to continue, to the actual costs of printing and distributing the Newsletter. The inaugural fee will be $5.00 for a year's subscription of six issues, beginning in the Spring 1980 semester. (For those subscribing after July 1, 1980, the charge will be $6.00.) At this rate, we are sure you will recognize that we are not motivated by a desire for net income, but rather that we cannot publish the Newsletter at all unless we raise enough money through subscriptions to cover basic operating expenses.

In order to determine the feasibility of continuing to publish the newsletter on a subscription basis, we ask that you assist us in a poll. We realize that this is something of an inconvenience, but you can appreciate its necessity and we ask that you please fill out the tearsheet below and return it to us. Please do not send money at this time. What we need is a firm response (amounting to 40% of the 2400 people who presently receive the Newsletter free) to justify the commitment necessary to continue publication on a regular basis.

Steven L. Goldman	Stephen H. Cutcliffe
Director, STS Program	Editor, STS Newsletter

(Cut on Dotted Line)

Return To:

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Science, Technology & Society
Curriculum Newsletter of the Lehigh University STS Program

Director: Steven Louis Goldman
Editor: Stephen H. Cutcliffe

Number 14
November 1979

In the following bibliographical article, Professor Carl Mitcham has analyzed Lynn White's thesis about the relationship between Christianity and technology and the subsequent literature which this thesis has engendered. Although somewhat longer than the articles normally carried in this newsletter, we have included it in toto, *believing it to be particularly informative and useful for course development in an area just now beginning to burgeon. References are contained in the bibliography appended to the end of the article.* Editor

Questions of Christianity and Technology:
A Bibliographic Introduction

One can distinguish two kinds of questions about the relationship between Christianity and technology. The first concerns the extent to which Christianity is responsible for the existence of modern technology --that is, with the effect of Christianity on technology. The second deals with the demands modern technology places on Christian life, and the proper response to those demands.

1.
Christian Responsibility for Technology

At the annual meeting of the American Association for the Advancement of Science held in Washington, D. C., in December, 1966, the medieval historian Lynn White, Jr. --the son of a Protestant clergyman-- delivered a paper of an admittedly popular nature which was destined to appeal to a whole generation of intellectuals disaffected with Christianity and sensitive to the ecological destruction of the earth. As subsequently published in Science, "The Historic Roots of Our Ecologic Crisis" argues that, at least in its dominant Western form, Christianity is responsible for the attitude toward the world that led to the rise of modern technology. The problem is the Judeo-Christian conception of man as superior to the rest of creation, and of everything else in creation as subject to man's use and enjoyment. The solution, White suggests, is to adopt a more Franciscan appreciation of nature --if not an Eastern Orthodox theology of the world.

White's essay has been picked up by every major anthology dealing with ecological issues from *The Environmental Handbook* (1970) on. In Ian G. Barbour's *Western Man and Environmental Ethics* (1973), White offered a further commentary on his thesis, criticizing especially the idea of "spaceship earth" as the logical extension of the Christian attitude. Subsequently, in *Medieval Religion and Technology* (1978), he collected the more scholarly papers in which his thesis was originally presented, together with an intellectual autobiography of how it came to be developed.

It is "The Iconography of *Temperantia* and the Virtuousness of Technology" (1969 --and reprinted in *Medieval Religion and Technology*) that is the central example of White's method and argument. By judicious interpretation of manuscript illustrations and homiletic images, White argues that beginning in the 9th century, and with overwhelming force by the middle of the 15th, the improvement and utilization of technological objects became a major element of Christian moral life. Temperance or discipline (which in earlier periods had been one of the lesser cardinal virtues) was elevated to a dominant position and symbolized by technology.

> Her essential character had become Measure, and, since we mortals dwell in time rather than eternity, her prime symbol came to be the clock. But then, toward the middle of the fifteenth century, Northern Europe clothed this supreme Virtue not simply with the clock but with the new technology of the later Middle Ages: on her head she wore the most complex mechanism of the era; her feet now rested on the most spectacular power engine of that generation; in her hands she held eyeglasses, the greatest recent boon to the mature literate man. The new icon of Temperance tells us that in Europe, below the level of verbal expression, machinery, mechanical power, and salutary devices were taking on an aura of "virtuousness" such as they have never enjoyed in any culture save the Western (pp. 201-202).

Science, Technology & Society, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of science, technology, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the STS field. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, STS Program, 216 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015.

That, prior to White's article, the religious issue had not been more central to intellectual debates on technology is somewhat strange. Such ideas reflect the shift from science to technology in the cultural interpretation of the science-technology continuum, in conjunction with the ongoing question of the relationship between modern natural science and religion that has been the subject of polemic and apologia at least since the trial of Galileo. It is surely associated, as well, with the tendency to push the origins of modernity back into the Middle ages and beyond --the extreme form of which is Heidegger's charge that Plato is responsible for modern metaphysics. As early as 1925, for example, Alfred North Whitehead, in *Science and the Modern World*, maintained that "faith in the possibility of science . . . is an unconscious derivative from medieval theology." (For Whitehead modern science is also closely allied with modern technology or "the invention of the method of invention.") In a series of articles in Mind between 1934 and 1936 Michael B. Foster argued the same point in a deeper manner, stressing (like White) the contributions of voluntarism in theology.

With more direct relevance, Max Weber, in *The Protestant Ethic and the Spirit of Capitalism* (1904), described capitalist modes of production and modern technology as born of the Protestant attempt to apply the asceticism of the monasteries to the everyday life. Later John U. Nef, in the *Cultural Foundations of Industrial Civilization* (1958), maintained that Renaissance delight in the world, and Catholic attempts to infuse human relationships with a new tenderness, also played their part. And, as White acknowledges, aspects of his thesis had been developed independently by the German historian Ernst Benz in "Fondamenti cristiani della tecnica occidentle" (1964). Perhaps such studies did not provoke the reaction of White's article because they could easily be misunderstood as having credited Christianity with an achievement, whereas White's article was clearly an indictment.

The wide response to White's article has taken two forms. On the one hand, his argument has been variously restated --as, for instance, in Arnold Toynbee's "The Genesis of Pollution" (1973). It has also been picked up and extended by many with a concern for environmental ethics. The architect Ian McHarg, for example, uses White's thesis as a basis for his theories of *Design with Nature* (1969). And in Europe the work of Carl Amery (1972), without any explicit reference to White, gives the strongest and most general statement of his argument, indicting even socialism, as a secularized form of Christianity, for its opposition to nature. (By contrast, Jacques Ellul [1980] defends the collateral anti-nature characters of both technique and Christianity.)

A more moderate adaptation of White's position has been undertaken by Christian theologians, particularly those associated with the liberal Protestant journal *Christian Century*, in an attempt to pursue White's suggestion for reconceiving Christian attitudes on the basis of ecological experience. Good examples can be found in James Livingston (1971) and Peter Heinegg (1976). Thomas Derr's *Ecology and Human Need* (1975) may also be said to fall into this category, as do two publications of the Faith-Man-Nature Group --*Christians and the Good Earth* (n.d.), and Glen Stone's *A New Ethic for a New Earth* (1971). Perhaps the best introduction to the Catholic version of this same approach is a symposium on "Ecology and Religious Education" from the journal Religious Education (1971). Gordon Kaufman's "A Problem for Theology: The Concept of Nature" (1972) is a more conservative and pessimistic probing of fundamental issues.

On the other hand, White has been criticized for having too limited a view. Lewis Moncrief in a reply in Science (1970) objects that White ignores cultural factors more important than religion. Yi-F[illegible] Tuan (1970) points to similarities between exploitative practices in both East and West. (It is interesting, however, that Joseph Needham, discussing the rise of Western technology in *Science and Civilization in China*, vol. 3 [1959], reaches conclusions compatible with those of White.) René Dubos (1972), as well, argues that other religious traditions have been as exploitative of nature as Christianity, and that Christianity has a strong tradition of active respect for nature. Dubos praises the "active wooing of the earth" in contrast to White's eulogy of the Franciscan love of nature as it is in itself. Michael Foley (1977), also, defends neglected aspects of the Judeo-Christian tradition, arguing that technology becomes destructive of the environment when it is cut loose from the Catholic Christian tradition. Foley's argument recalls that of someone like Christopher Derrick, who in *The Delicate Creation* (1972) blames an unconscious Manicheanism for the technological destruction of the earth. Among Protestant theologians in the Calvinist tradition, Heinrich Emil Brunner (1949) and Egbert Shuurman (1977) also criticize the cutting loose of technology from Christian motivation.

At another level, White's argument has been criticized for its particular interpretation of biblical texts. Bernard Anderson (1975) interprets Genesis 1:26-28 as showing evidence of a democratization of royal theology popular at the time of David, thus implying a domination tempered by responsibility. Paul Santmire, in "Reflections on the Alleged Ecological Bankruptcy of Western Theology" (1975), argues that the ecological crisis was caused not by Hebrew thought but by modern natural science, the philosophy of Kant, and the ideology of modern capitalism. Citing the absence of any theology of nature in Karl Barth, Santmire maintains that Kantian philosophy acted like a sieve to remove the ecological aspects of Reformation theology. What is needed is precisely a theocentric view of nature akin to that of the Reformers, because this could do more than appeals to St. Francis, Eastern Orthodoxy, or Zen to raise ecological consciousness among WASP suburbanites. In another article (1976), Santmire provides a good overview (with bibliography) of the disputes that have emerged between politically and ecologically oriented moral theologies.

2.
The Christian Response to Technology

Moral theology tends to focus more on the special ethical problems created for Christianity by technology than on how in the past Christianity contributed to the rise of modern technique. The predominant issues from this perspective concern the practical application of Christian ethics to social justice issues aggravated by modern technology, and the problematic character of religion in a secular, technological world. The former has generated a large volume of literature which has largely ignored the kinds of questions posed by White. The latter is almost intractable, precisely because those who are aware of it at any depth are also conscious of the Christian ambiguity toward the secular which is at the core of White's thesis.

With social justice issues in the West the focus has been either on the dangers of nuclear war, on the unfair distribution of wealth --or, in what is undoubtedly the issue that demands the most attention, on the ethical dilemmas of birth and death engendered by advances in medical technology. Representative introductions to the problems and arguments in the first two areas can be found in Birch and Rasmussen (1978), Hamilton (1977), Abrecht (1978) --not to mention the Papal encyclicals *Pacem in Terris* (John XXIII, 1963) and *Populorum Progressio* (Paul VI, 1967). With regard to Christian bioethics, one can do no more than call attention to Richard McCormick's (1972) helpful bibliographic survey, to a recent article by James Gustafson (1978), and to the work of the somewhat conservative Protestant theologian Paul Ramsey. From *Fabricated Man* (1970) to *Ethics at the Edge of Life* (1978) Ramsey has occupied a central place in this field, one which includes a grappling with the problems of nuclear war (1969).

Technology and the secular exist in evident tension with religion and the sacred. Important early attempts to explore aspects of this tension can be found in an essay by Nicholas Berdyaev (1934) --and in two collections, one edited by Robert Mohan (1960), the other by Hugh White, Jr. (1964). Despite hippie dreams of "electric Tibet," and vapid intellectual babble like Andree Bindewald's (1978) about the integration of body and spirit, this issue remains a critical one. As Frederick Wilhelmsen (1975) has so felicitously put it, "Religion bends the knee" but technology "makes man walk erect." The search for a resolution of this tension generally moves in two different directions: one toward a reinterpretation of religion, the other toward a reinterpretation of technology. Yet it remains a decidedly open question whether either of these two approaches is anything more than wishful thinking.

The first approach has on its side exactly those aspects of the Christian tradition to which White so persuasively appeals. In modern culture, if the secular has become autonomous and dominates the sacred, it is at least partly because of some Christian ideas about the nature of the secular. Gabriel Vahanian (1976), for example, suggests that the Christian critique of myth is the foundation of modern technology. Thus, whereas originally Christianity adapted itself "to the constraints of natural religion," consistency now requires that it adopt "the framework of a religious sensibility determined by technology." This involves a shift in theology from an emphasis on the divine in nature to the divine in technological visions of the future (utopianism), and in church structure from priestly to prophetic ecclesiology. More vulgar presentations of similar positions can be found in Harvey Cox (1965), Emmanuel Mesthene (1967), and R. A. Buchanan (1968).

The most straightforward example of the second approach is to argue for placing technology at the service of Christian ends or values --as has been done, e.g., by W. Norris Clarke, S.J. (1963). William Lynch, S.J. in *Christ and Prometheus* (1970), argues further that the autonomy of technological man presents a decisive challenge to the religious imagination which can be met by envisioning "autonomy . . . not [as] a defiance but [as] grace." Technological culture is to be interpreted not as the negative force of Eric Gill (1940) or Georges Bernanos (1947) but as a divine gift. The appeal of Teilhard de Chardin's optimistic synthesis of evolution and scientific-technological progress, especially as extended by Walter Ong, S.J. (1967), no doubt rests on a similar desire to re-enclose the secular within the sacred.

The difficulties with this second approach, that which seeks to affirm the spiritual value of technology, are considerable. Not to mention the evident paradox of conceiving the secular attack upon Christianity as a gift from the victim to himself, it is difficult to see how such a position does not finally collapse back into the first approach. If technology is really a gift, why not adapt to it? It is as if Moses, in counseling the Hebrews to "spoil the Egyptians" (St. Augustine), had told them to take not the gold and silver of their masters, but the pyramids. Had they tried, they would have never gotten out of the land of their captivity. For, in Ellul's words, "One can safely say that there can be no such thing as a Christian influence on technology itself" (1967).

The depth of the difficulties which modern technology creates for Christianity have been vividly present in the first year pilgrimages of Pope John Paul II. In Communist Poland, he called upon Christians to resist modern (technological) totalitarianism. In the United States he warned against a culture of moral laxity. Whereas in the Third Worlds of Mexico and Ireland, he called for social development --but on neither Communist nor capitalist models, both of which fail to measure up to spiritual standards.

Whether there is any way to harmonize technological development and the spiritual life is the ultimate issue. Ironically, Lynn White's historical research points to the possibility of just such a harmony, but one which is self-destructive. Whether there are others less fraught with contradictions is the final burden of Ellul's socio-theological studies (1975, 1977), plus those more strictly sociological analyses of Third World countries by committed Christian laymen such as Denis Goulet (1977) and Peter Berger (1973, 1974) --not to mention the religiously based social criticisms of Ivan Illich (1973, 1978). The witness of spiritually sensitive artists and intellectuals, even when not overtly Christian, also must not be ignored. And the counsel of the experience of other religious traditions must also be considered. The revolution in Iran is certainly one such experience. So is that expressed by Swami Bon Maharaj: "The Supreme purpose of human birth is . . . God-realization, and Man is yet to find out how far science and technology can be helpful to this" (1973).

oooo Carl Mitcham
St. Catharine College
St. Catharine, Kentucky

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N.B.: For a number of other works on this subject one should check C. Mitcham and R. Mackey, *Bibliography of the Philosophy of Technology* (Chicago: University of Chicago Press, 1973), under Religious Critiques, and subsequent current bibliographies in Paul T. Durbin, ed., *Research in Philosophy and Technology*, vols. 1 (1978) and 3 (1980).

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Technology and Human Needs

For well over a century, the community of industrialized nations has grown increasingly scientific and technically oriented. To have lived between 1850 and about 1950 was to have participated in a great technological adventure. During this time, many believed that, if engineers could only apply their objective problem-solving approach to social problems, then wars would cease, poverty would vanish, and Utopia would be at hand. But, alas, more than 100 years later, war and poverty continue to persist and Utopia is still far away.

The technical values that come to us from the recent past are not considered as authentic as they once were. It is no longer possible for an engineer to settle comfortably into an optimistic value system, without examining the nature of the assumptions of that value system. Because wars have not ceased, nor has poverty vanished, it is not surprising that this positive attitude toward technology is in a state of turmoil and reevaluation. One natural result is an increased concern about rebuilding a sound or meaningful value system which can hold its own in today's technical world.

The anti-technologist has project an image of the engineer as someone who is busy making carefully calculated, practical applications of scientific knowledge. In this image the archetypal engineer is insensitive, viewing his surroundings with little or no emotion. Psychological studies of the personalities of engineers show that there is some truth to this stereotype. The typical engineer leaves introspection and value formation to the humanities, and, although engineers get along well enough socially, they would rather deal with things than with other human beings.[1] Society is only now learning to recognize that people are uncomfortable when treated as objects. There are significant differences between the "I" "It" relationships between the scientist and the material universe, and, the "I" "You" relationship between human beings.[2]

The socio-technical system of the future should encourage the physical and emotional health of living organisms. The satisfaction of basic human needs encourages living organisms to reach a healthy balance between themselves and their surroundings. For those fortunate enough to have satisfied their basic needs, many of the conflicts of today seem to dissolve.

When a human being is inwardly free to choose that which is deeply valued, the tendency is to choose those objects, experience, and goals that make for personal and social growth. If the human species to survive, the development of such values is necessary. In the ongoing process of evolution, the human being must be able to select that which is valuable for development out of new and complex technical situations. Desirable human and social values can be encouraged by a technology which concerns itself with the satisfaction of human needs.

After a great deal of clinical study, Dr. Abraham Maslow has established a hierarchy of basic needs which suggests many of the basic needs of the growing and changing human organism.[3] Technology has already contributed greatly toward assuring the satisfaction of many of these needs. In order to emphasize the hierarchic structure of Dr. Maslow's system we can list the basic needs by starting from the bottom, or center, and growing outward and upward:

↑ Aesthetic Needs
Self-actualization Needs
Knowing and Understanding Needs
Esteem Needs
Love and Belongingness Needs
Safety Needs
Physiological Needs

Each lower level must be satisfied before the next higher need appears. In the process of growth and maturity, values will overlap and our minds will change depending upon our personal needs and level of gratification.

Similarly, although starting with different assumptions, Dr. Erik Erikson has developed his own eight, life-affirming stages of growth.[4] Again, each lower stage must be developed and satisfied before the next higher stage appears. The underlying assumption is that the human organism develops according to steps predetermined in the growing person's readiness to be driven toward, to be aware of, and to interact with a widening social circle, and that the good society, in general, tends to be constituted in such a way as to meet and invite this succession of potentialities.

In the future, society will require educated people to have interpretive skills even more than operational skills. Computers can now do many operational skills with great speed and accuracy. The "educated person" who knows a lot of isolated scientific facts but cannot fit them into some kind of creditable value system within a concerned community will be of little use. Society will need the kind of intellectual recently described by John Knowles, president of the Rockefeller Foundation, as one who "integrates and synthesizes disparate knowledge into a coherent whole and tells us what should be done humanistically, as well as what can be done scientifically and technically."[5]

Since technology builds upon and is an extension of the human senses, a soft technology based upon satisfying human needs, can have a civilizing effect upon society, easing the tensions that produce crisis. Technology can be looked upon as another way of assisting human growth toward self-actualization within a concerned community.

--H. Carlton Moore, Jr.
Civil Engineering
Wentworth Institute
Boston, Mass.

Footnotes

1. For further discussion of psychological studies of engineers see Samuel Florman, The Existential Pleasures of Engineering (New York: St. Martin's Press, 1976), p. 91, 92.

2. Martin Buber, I and Thou, Trans. by Walter Kaufman (New York: Charles Scribner's Sons, 1970), p. 68, 100ff.

3. For a more detailed discussion see A.H. Maslow, Motivation and Personality (New York: Harper & Row Publishers, 1954), p. 80ff.

4. Maslow's hierarchy is of a pragmatic nature derived from clinical observation. Erickson's hierarchy is based upon Freudian theory and details a life denying dimension to the hierarchy as well as a life affirming dimension. For further details see Erik H. Erikson, Childhood and Society (New York: W. W. Norton & Co., Inc. 1963), p. 273.

5. Susan Scheifelbein, "Confusion at Harvard, What Makes an 'Educated Man'?", Saturday Review of Literature April 1, 1978.

Course Syllabus

SCIENCE, TECHNOLOGY AND SOCIETY

Anthropology 131

Prof. Barbara Frankel
Dept. of Social Relations
Lehigh University

This course will examine the relationships of science and technology to social life across time and space, using theoretical models for understanding these relationships. In addition to class participation and several short written exercises, you will be required in lieu of a final exam, to submit a term paper of ten pages or more focusing on one of the following general topics: (a) Social control of time, (b) Social control of space or (c) Social control of information and knowledge. For this paper you will employ what you have learned in class and additional library research to explore the science and/or technology of these topics.

Required Readings: Items listed are in the bookstore in paperback or reprint form, except those marked with an asterisk, which are on reserve at Linderman Library. I have, however, put such copies as are available on reserve.

*Bateson, Gregory: "The Cybernetics of Self" in *Steps to an Ecology of Mind*.
Childe, V. Gordon: *Man Makes Himself*.
DeCamp, L. Sprague: *The Ancient Engineers*.
*Kuhn, Thomas: "The Function of Dogma in Scientific Research".
Pelto, Pertti: *The Snowmobile Revolution*.
Pirsig, Robert M.: *Zen and the Art of Motorcycle Maintenance*.
Service, Elman: "The Law of Evolutionary Potential" (reprint, and in Sahlins and Service, *Evolution and Culture*.
Sharp, Lauriston: "Steel Axes for Stone-Age Australians".
*White, Leslie: Chapter 1 of *The Evolution of Culture*.
White, Lynn Jr.: *Medieval Technology and Social Change*.
Wiener, Norbert: *The Human Use of Human Beings*.

Course Outline and Reading Assignments

Week 1	Organizing session. Beginning to define some terms.
Part I	Science, Technology and the Divided Self
Week 2	Read Pirsig's *Zen and the Art of Motorcycle Maintenance*, Chapters 1 through 18, using Reading Guide provided as preparation for class discussion.
Week 3	Read the rest of Zen. (This time you decide what's important.) Read Kuhn article (on reserve).
Part II	The Historical Panorama of Technological Progress
Week 4	Read DeCamp, Chapters 1 through 5.
Week 5	Read DeCamp, Chapters 6 through 9.
Week 6	Read Lynn White, Chapters 1 and II.
Week 7	Read Lynn White, Chapter III.
Week 8	Read Sharp article (reprint) and Pelto Chapters 1-7.
Week 9	Read Pelto to the end, including Appendixes.
Part III	Theoretical Approaches to Understanding Science, Technology and Society: From Hardware to Software, Determinism to Contingency
Week 10	Read V. Gordon Childe, Chapters to be assigned.
Week 11	Read Leslie White, Chapter 1 of *Evolution of Culture*, entitled "Man and Culture," (on reserve) and Service reprint.
Week 12	Read Wiener, Chapters 1 through V.
Week 13	Read Wiener, Chapters VI through XI.
Week 14	Read Bateson article "The Cybernetics of Self" (on reserve). Bring your perplexities to class - in regard to papers or anything else that has not been dealt with earlier - for the second session of this week, which will be summary.

The above syllabus, I think, speaks more or less for itself. The course was originally conceived as focusing upon technological determinism as a school of anthropological thought, and this is still one of the threads that ties it together. But it has undergone considerable revision since it was first taught, and probably will again in the future.

The first reading, Pirsig's Zen.... is my sneaky way of introducing a bit of philosophy of science in palatable form, and it also seems to me to point to certain relationships between science as an intellectual enterprise and technology as its offshoot. Pirsig's reading of intellectual history since Plato may be open to question, but is well worth thinking about. The relationship between Pirsig and Kuhn is obvious and probably not at all fortuitous; both men might be seen as products of a relativistic age, and both see science as a social product.

The readings in the history of technology are anthropological, I think -- and the book by Pelto, an anthropologist, has an historical aspect. The thrust here is to give students some factual grist for the theoretical mill -- concrete cases in which one ought to consider whether the form of society is technologically determined or whether other theoretical models (eg. non-linear ones such as cybernetic-systems-information theoretical approaches) make more sense. The issue of deterministic vs. probabilistic scientific world views is central here.

The theoretical issues are brought into focus in the third section of the course, though they have been broached earlier. Childe and White are both rather strict determinists. Service's work is based upon that of White, although it develops a more sophisticated notion of social evolution that is explicitly based upon a criterion of energy use, in which the more advanced societies are also the greatest energy consumers. Weiner's cybernetic approach, in contrast to that of the techno-economic determinism of the three anthropologists just mentioned, is probabilistic rather than deterministic, posits feedback loops rather than linear chains of causality, and sees information as the key to all forms of organization, rather than energy. Bateson, an anthropologist, also rejects what he calls "19th century energy-distribution models" of both individual psychology and group behavior and subscribes to a cybernetic approach to the understanding of human activities.

Paper topics fall under three major rubrics: social control of time, social control of space, and social control of knowledge. Under these three broad headings almost anything seems to be possible; I have gotten papers on anything from cryogenics as a means of extending the lifespan (social control of time) to the significance of the greening of the desert through modern agronomy (social control of space) or the effects of such inventions as the telephone, the SST and space travel on our control of both space and time. Under social control of knowledge there have been ingenious topics chosen. I have had ones on new categories of crime such as stealing computerized information and/or antibiotic cultures, on who runs the media and how this affects what we know of events, and on medical specialization, just to name a few.

On the whole I learn a lot from the papers in this course. Most of them have some relation to a topic that is of genuine interest or utility to the student writing it, so that even the quiet students one is not sure are bright often produce something quite worthwhile. In view of the fact that this is a 100 level course, I take few skills for granted and distribute an outline stating exactly what I expect a paper to contain in terms of form and content -- and adopting this technique seems to work well in eliciting solid, well-researched work.

ENERGY AND THE WAY WE LIVE:

A Multi-Media Announcement

"Energy. It's certain to be the number one issue of the 1980s" reads the first line of an advertising brochure for a new multi-media educational package designed to educate the public on energy issues. Courses By Newspaper (CbN), a project of University Extension, University of California, San Diego, which is funded by the National Endowment for the Humanities, has developed a fifteen-week series of newspaper articles scheduled for release beginning January 20, 1980. The series, coordinated by Melvin Kranzberg, Callaway Professor of the History of Technology at the Georgia Institute of Technology, will explore the multi-faceted energy issue, its policy options, and its trade-offs. The authors and subjects in the order in which they will appear include:

UNIT I: THE CURRENT ENERGY DILEMMA

1. *Dorothy K. Newman* - Our Energetic Life Style
   How would life change if our daily energy ration were cut?
2. *S. David Freeman* - "Cry Havoc" or "Cry Wolf"? The Nature of the "Energy Crisis"
   Is public skepticism about the "energy crisis" justified?

UNIT II: "LESSONS" FROM THE PAST: PROBLEMS, SOLUTIONS, AND MORE PROBLEMS

3. *Lynn White, Jr.* - Substitutes for Human Muscle: Past Crises
   What problems occurred during earlier transitions from one energy source to another?
4. *John G. Burke* - Multiplying Energy: 19th and 20th Century Developments
   What energy innovations fueled the emergence of modern, industrialized society?

UNIT III: ENERGY AND VALUES

5. *Daniel Bell* - Plenty and Profligacy: Energy and Growth in America
   How is energy consumption tied to American values?
6. *Norman Metzger* - Prelude to Crisis
   What well-meaning social programs have gradually contributed to today's energy problems?
7. *John K. Cooley* - Other People, Other Patterns of Energy Use
   What are the international implications of energy shortages and increasing American dependence on foreign oil?
8. *Joel Darmstadter* - The International Politics of Energy
   What is the relationship among energy use, standard of living, and values?
9. *Kenneth E. Boulding* - The Global Lifeboat: Energy and the Third World
   Does America have an obligation to share energy resources with have-not countries?

UNIT IV: ALTERNATIVE SCENARIOS FOR OUR ENERGY FUTURE

10. *Don E. Kash* - Conventional Fuels in Transition
    What are the potential dangers linked to increased production and use of oil and coal?
11. *Alvin M. Weinberg* - Nuclear Energy: A Faustian Bargain?
    Do the benefits of nuclear energy outweigh the risks and social costs?
12. *Wilson Clark* - Solar Energy and "Appropriate Technologies"
    Can alternative energy sources meet the needs of industrial socity?
13. *John H. Gibbons and William Chandler* - Making Our Own: Synthetic Fuels
    Will technology solve our energy problems?
14. *Denis Hayes* - More Through Less: Effective Energy Use
    Will energy conservation diminish or enhance our quality of life?
15. *Melvin Kranzberg* - Choosing Our Future: Choices and Tradeoffs
    What difficult decisions must be made in shaping America's energy future?

For further information on the CbN series, Energy and the Way We Live, or how to get your local newspaper to offer the series, write to George A. Colburn, Director, Courses By Newspaper, University of California, San Diego, X-002, LaJolla, CA 92093 or telephone: (714) 452-3405. CbN will also work with a newspaper to interest a local educational institution in using the series as the basis of a credit or non-credit course.

The American Association of Junior and Community Colleges has developed a *National Issues Forum* on Energy and the Way We Live to be held during February, March, and April. This nationwide program is designed to draw people from all walks of life into discussions about our nation's energy future. The Calendar of Issues outlined below is designed to serve as a catalyst for a series of community gatherings throughout the 10-week period.

FEBRUARY	THE DEVELOPING ENERGY CRISIS: A LONG TRADITION
1-16	The Sources of Concern: Crisis or Problem?
17-23	The Search for Solutions
24-March 1	Growth Through Energy: The American Past
MARCH	ENERGY: WHAT MATTERS MOST?
2-8	Energy and the Good Life
9-15	Energy: Patterns of Living and Working
16-22	Energy and Our Political and Economic Institutions
23-29	Energy...With Justice For All
APRIL	FINDING THE PATH TO AN UNCERTAIN FUTURE
March 30-April 5	Energy: Decisions and Tradeoffs
6-12	Energy Self-Sufficiency and Global Interdependence
13-19	Future Options and Hard Choices

Further information on the *National Issues Forum* may be obtained from Diane U. Eisenberg, Director, Community Forums Office American Association of Community and Junior Colleges, One Dupont Circle, N.W., Washington, D.C. 20036 or telephone: (202) 293-7050.

National Public Radio and local cable television stations will also be involved in the Energy package. NPR will broadcast a 7-part series of half-hour documentaries to be aired over the 215-station network beginning in January 1980. For dates and times of NPR's programs, consult your local member station. WTBS, the Atlanta "superstation", will feature a variety of programs including a nine-hour telethon announcing the energy forum series, five specials, and a ten-part series of interviews all tied to the Energy and the Way We Live Calendar of Issues. These programs will be delivered by satellite to over 1,000 cable systems across the country. Air dates and times can be obtained from your local cable station.

Two texts published by Boyd and Fraser of San Francisco will supplement the Energy package, as was the case with the Fall 1979 *Connections: Technology and Change* history series (see review in issue #12, pp. 13-14).

Melvin Kranzberg, Timothy A. Hall, and Jane L. Scheiber have edited a Reader/Study Guide also entitled Energy and the Way We Live. The reader contains excerpts from books and journal and magazine articles designed to address the fundamental questions: What kind of life do we want and how, in a democracy, do we make the decisions about energy sources and uses that will help us achieve our goals? The volume is organized into four major sections corresponding to those of the newspaper series. The appended study guide is designed to relate the newspaper series and reader articles, highlights important concepts, and provides self-test questions and suggestions for essay assignments or discussions.

Boyd and Fraser has also published a "Source Book", again under the same key title, Energy and the Way We Live. The Source Book is designed for use with the *National Issues Forum* coordinated by the American Association of Community and Junior Colleges. It offers suggestions for background reading, books to review, and discussion questions as well as program suggestions and resources to go along with each of the fifteen CbN articles. The Source Book also includes a list of energy-oriented organizations, agencies, and groups which offer materials such as brochures, booklets, books, films, and slide presentations free or for sale. Some are also sources for speakers. The volume concludes with an annotated list of films, again coordinated with the weekly CbN series.

The Reader/Study Guide and the Source Book are available from Boyd and Fraser Publishing Company, 3627 Sacramento St., San Francisco, CA 94118 at $9.95 and $2.95 each respectively. Orders must be prepaid and accompanied by an additional 75 cents per book for postage and handling.

The complete package of newspaper articles, radio and television programs, local forums, and texts should provide an interesting mix of approaches to the "energy issue" which is presently facing the public. SHC, *Editor*

Icons of Science Fiction: A Book Review

Over the past year several students have shown me a comic strip which captures the dual nature of science fiction quite well. It starts with a professor lecturing a class on the serious societal reasons for reading science fiction and ends as he turns to his text: "The Ant That Ate Toledo." How can a body of literature built on such images ever be taken seriously??? Gary K. Wolfe's new book, *The Known and the Unknown: the Iconography of Science Fiction* (Kent State University Press, 1979, $12.50), shows us a way. Wolfe, borrowing from analyses of myth, begins with the premise that "the transformation of Chaos into Cosmos, of the unknown into the known, is the central action of a great many works of science fiction." Then, using many examples from the 1930s to the 1960s, he demonstrates how five of science fiction's most familiar images contribute to this worthy cultural function.

Contrary to popular belief, the spaceship is seldom used principally as a phallic symbol, or, like the horse in the western, as a transportation device. It is more often pictured as a hearth, a womb, a traveling drawing room, a place of security and comfort, a home, a repository of traditional values in alien territory. The spaceship contains self-contained societies, space families, and sometimes is even "human" itself. In a hostile but ultimately transformable universe, the spaceship gives man the means to appropriate the unknown, and leaving the spaceship is a symbolic birth, an act aimed at helping the human race recreate itself in an environment once chaos.

Also contrary to popular belief, science fiction has not promoted urbanization. The image of the city leans more toward the smoky cellars of *Metropolis* than the gleaming towers of megalopolis. Cities in science fiction are barriers which trap and limit man, preventing him from appropriating the unknown. Since cities are centralized, collectivistic, xenophobic, authoritarian, stable, unnatural, of the past, regressively technological, superfluous, and chaotic, they are barriers to the questing spirit of man. Cities, then, are beginnings not ends, and the structural movement in most science fiction about cities is outward from a weakening center.

In the wasteland image, such things as war, nuclear accident, plagues, poison gases, ecological disasters, and riots turn familiar environments into unfamiliar ones, turn the known back into the unknown. The function of these stories is to affirm technological values by recreating the familiar and the known, by rebuilding civilization. By fighting again against hostile environments, by using science and technology for survival rather than for ambition, mastery, or power, we can recapture the real meaning and importance of our reason and our tools.

The image of the robot/computer, extensions of our hands and brains, sheds light on our relation to our tools and our place in the universe. Once a simple human function has been replaced, where will it stop? What will happen to us? The tool becomes a god. Machines assist, supplant, imitate, and supersede man, but they end - surprisingly - recreating him. The ultimate purpose of machines in science fiction is to recreate or rediscover humanity. The human image becomes the Platonic ideal toward which machines strive. Humanity is precisely the purpose of a mechanistic universe.

The Monster is a direct symbol of the unknown, an agent of Chaos, the unreason hidden by all rational structures, the opposite of technology. The Monster is less a villain than a problem, something to be appropriated rather than annihilated, understood rather than destroyed. The only way to conquer a Monster is to know it, to use science and technology to subdue Chaos and restore order. The Monster reminds us fearfully of our animal origins, our terrestriality, our vulnerability, but every victory over the monster broadens human knowledge and power. Human understanding is enhanced by knowing the beast.

Wolfe turns what many people consider exhausted images indicative of sterile conventionality into explosive icons representing fundamental beliefs and values, and in so doing he gives our appreciation of science fiction a healthy jolt.

--Edward J. Gallagher
Dept. of English
Lehigh University

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BUSH, GEORGE P., AND DREYFUSS, ROBERT H., EDS. TECHNOLOGY & COPYRIGHT. MT. AIRY, MARYLAND: LOMOND BOOKS, 1979. VIII, 552 P.

The Copyright Law of 1976, intended in part to address new problems created by such technological advances as photocopiers and videotape recorders, has confused perhaps more than it has clarified. This sourcebook provides a useful guide to a number of concerns. An annotated bibliography encompasses articles, books, legislation and reports on copyright as related to information technology in general, computer systems, reprography, video communications, microforms, education, libraries, and other areas. Articles collected in the seond part treat such issues as the copyright status of machine-readable data bases, Betamax recording of copyrighted TV programs, and the impact of library photocopying on scholarly publishing.

DERTOUZOS, MICHAEL L. AND MOSES, JOEL, EDS. THE COMPUTER AGE: A TWENTY-YEAR VIEW. CAMBRIDGE: MIT PRESS, 1979. 491 P.

In twenty-two essays scientists consider the changes computers will effect during the next twenty years in economics, education, business, government, science, society and culture, and the home. Among outstanding contributions are Terry Winograd's article on "convivial computing," Joseph Weizenbaum's careful view of the computer revolution with replies by other scholars, a discussion of the social framework of the information society by Daniel Bell, a consideration of the effect of government regulation on public computing services by Roger Noll, and Martin Minsky's evaluation of the difficulties of producing artificial intelligence.

GOODPASTER, K. E. AND SAYRE, K. M. ETHICS AND PROBLEMS OF THE 21ST CENTURY. NOTRE DAME, IND.: UNIVERSITY OF NOTRE DAME PRESS, 1979. 210 P.

Essays by prominent philosophers "exploring the interface between ethical theory and certain practical problems of an environmental and social nature" attempt to illustrate the value of critical ethical methodology as guidance for decision-making in situations demanding moral response. Analyses of an environmental ethic precede studies of morality in technology assessment, "corporate modernity," nutrition, biomedicine, and historic preservation.

GREEN, MARTIN. "WRITING ABOUT ENERGY." ALTERNATIVE FUTURES 2 (SUMMER 1979): 3-16.

A professor of English contrasts the intellectual and literary style of a prominent proponent of nuclear power, Hans Bethe, and a vocal opponent, Amory Lovins. Not disguishing his own anti-nuclear sentiments, Green concludes from a brief comparative review that Bethe exhibits strong faith in power, big science and big institutions in general. Lovins, in contrast, emerges from his writings as the "intellectual's Ralph Nader, our David against the Goliath complex." However, while agreeing with his ideals, Green is less pleased by Lovins' prose. He finds it marred by rhetoric, unintegrated statistics, unnecessary accumulation of detail, cryptic allusion and the use of the unfortunate phrase "soft technology." It is up to nonspecialists (like literary scholars) to overcome the linguistic failures of well-meaning anti-nuclear technologists.

HESS, KARL. COMMUNITY TECHNOLOGY. NEW YORK: HARPER & ROW, 1978. 107 P.

Hess harbors a strong and admirable belief in the sanctity of and human need for the community. However, he is convinced that the only true neighborhood is a self-sufficient island: "The neighborhood totally dependant on outside institutions for technology will be shaped by purposes of those institutions rather than by the purposes of neighborhood citizens." In accordance with this belief, Hess and some associates spent five years attempting to convince the residents of the Adams-Morgan area of Washington, D.C. that they ought to embrace self-sufficiency. Urban gardens were planted; a basement sported a trout tank; plans for recycling centers, neighborhood industries, and alternative energy were discussed at meetings. Nothing caught on. Why? Hess blames big government, big business, unreachable blacks, lazy hippies - but rarely the wisdom of his own ideas or methods.

MARTER, JOAN M. "THEODORE ROSZAK'S EARLY CONSTRUCTIONS: THE MACHINE AS CREATOR OF FANTASTIC AND IDEAL FORMS." ARTS MAGAZINE (NOVEMBER 1979): 110-113.

Roszak's artistic productions have been eclipsed in recent decades by his sociological writings on technological civilization. Marter's tracing of the formation of Roszak's technology-science inspired style in sculpture is therefore welcome. She documents his career from the Art Institute of Chicago, to study in Prague, to work with Moholy-Nagy as an instructor at the Design Laboratory in New York. The "constructions" produced between 1932 and 1945 demonstrate that he was among the first Americans to adopt machine aesthetics and to view the artist as a molder of industrial society.

OWEN, WILFRED. "TRANSITION TO AN URBAN PLANET." BULLETIN OF THE ATOMIC SCIENTISTS. 35 (NOVEMBER 1979): 12-18.

That urbanites tend to have higher incomes and more access to education and employment possibilities has convinced Owen that "urbanization needs to be encouraged . . . as an instrument of development." The task is to overcome the disastrously haphazard growth that has characterized urbanization in developing countries. Exemplifying such a victory over chaos is Singapore, where the bold planning of a city-building corporation has been coupled with the labors of a newly created supply and construction industry assembled from the cadres of the unemployed. The renovated old city is now encircled by industrial-residential satellites; villages and medium-sized cities have also been improved. While similar projects in Korea and Hong Kong have enjoyed success, a failure to integrate the poor into the economy of Brasilia has hindered that city's progress. Owen stresses the need for global projects to furnish essential shelter and minimum services to urban areas where indigenous efforts have failed.

ROLLIN, ROGER B. "DEUS IN MACHINA: POPULAR CULTURE'S MYTH OF THE MACHINE." JOURNAL OF AMERICAN CULTURE 2 (SUMMER 1979): 297-308.

Popular culture, especially in the forms of movies and television, has long anthropomorphosized machines into heroes and villains; but more recently the tendency is a metamorphosis of the human hero or villain into machine. Beginning with the Wizard of Oz where Oz and the Tin Man are opposites --"a man pretending to be a machine, and a machine trying to become a man"-- Rollin chronicles how film has used mechanized things such as planes, cars, and robots to serve as ego extenders. Recently in Star Trek, 2001, Star Wars, and the TV cyborgs, the anxiety of losing humanity to the control of mechanized powers is carefully soothed. Popular culture serves its main function --the "feeding of our complacency."

ROSZAK, THEODORE. PERSON/PLANET: THE CREATIVE DISINTEGRATION OF INDUSTRIAL SOCIETY. GARDEN CITY, N.Y.: ANCHOR PRESS/DOUBLEDAY, 1978. XII, 346 P. BIBLIOG.

A number of trends --from the growth of special issue movements for women, Indians, homosexuals and others, to the reawakened interest in mysticism and spiritualism-- suggests to Roszak the beginnings of a revolt against massification. "We live in a time when the very private experience of having a personal identity to discover, a personal identity to fulfill has become a subversive political force of major proportions." From an acute vision of the self and a personalist ethos may evolve heightened respect for nature and human relationships, accompanied by disenchantment with the oversized political and technological structures that now threaten to engulf the individual.

°°°Christine Roysdon
Lehigh University Libraries

°°°Judith Mistichelli
Library of Congress

Co-author Judith Mistichelli, who has recently become a reference librarian at the Library of Congress, will provide assistance to readers of the STS Newsletter in areas which may be facilitated by resources at the Library of Congress. Contact Judy at Library of Congress, General Reading Rooms Division, 10 First Street, S.E., Washington, D.C. 20540; or call 202-287-5526.

OPEN FORUM

Ethics in Science:

Conference - Workshop on Pedagogical Issues in Teaching Ethics in College Science Courses

Under a joint NSF-NEH grant, Vassar College will conduct the above entitled 5 day conference-workshop, June 10-14, 1980. Although ethical and value-laden issues in the Sciences will be discussed, the emphasis of the conference will be on the rationale for inclusion of such issues in undergraduate science courses and, in particular, on a critical analysis of the pedagogical problems engendered by their inclusion or exclusion. In addition to a search for as many general conclusions as possible, specific attention will be focused on the different problems teachers may encounter: in 2-year vs. 4-year colleges; in technical vs. liberal arts colleges; in the social, physical, biological and applied sciences; in introductory vs. advanced coursework; etc.

The conference will consist of a mixture of lectures, workshop sessions and contributed papers. Early in the conference there will be two sessions of 15-minute papers contributed by conference participants. Each paper should treat some aspect of the teaching of ethics or values in science courses; it could be a position paper, arguing a particular stand on ethics and values in these courses, a paper proposing a new teaching venture or pedagogical approach pertinent to ethical issues in the sciences, or a summary of a teaching experience which included a treatment of ethical issues. While a good selection of such papers is expected, participation in the conference is not contingent on the submission of a paper. It is expected that approximately 100 college faculty members with as good a mix as possible from varied institutions and from the biological, physical (i.e. chemistry, geology, physics), social and applied sciences will attend. In addition, the participation of humanists and others teaching courses at the undergraduate level in the sciences will be welcome.

For further information on conference costs or to apply, please write to Professor Morton Tavel, Box 471, Vassar College, Poughkeepsie, N. Y. 12601, by January 31, 1980. Your application should include a brief curriculum vitae and should stress your teaching experience and your particular reasons for wanting to participate in the conference. If you wish, in addition, to submit a paper, include an abstract of approximately 250 words. In order to obtain a mixture of topics that is appropriate for the conference, the acceptance of papers will be selective. All accepted applicants will be notifed by February 15, 1980. Those whose papers are also accepted should submit a typed copy of the entire paper by March 15. The final program will be sent to all participants in March or April, along with travel instructions and preliminary reading material. Neither submission of a paper nor priorexperience in teching ethical issues is a requirement for acceptance.

Philosophy of Technology

Bibliographical Update

The July 1979 issue of the *Philosophy and Technology* Newsletter contains an annotated bibliographical listing of thirty-five books and articles published primarily in 1977 and 1978. The listing represents part of an ongoing bibliographical project (see *Issue #5*, April 1978, p. 19) under the direction of Carl Mitcham and Jim Grote. Contributed annotations for future bibliographical updates may be addressed to Carl Mitcham, St. Catharine College, St. Catharine, KY 40061. Inquiries regarding the *Philosophy and Technology* Newsletter may be addressed to Paul T. Durbin, Editor, Center for Science and Culture, University of Delaware, Newark, DE 19711.

The MIT Program in Science, Technology, and Society,

with the support of the Exxon Education Foundation, invites applications for several one-year research fellowships on the relationships of science, technology, and society. Selection criteria include: a) a record of outstanding performance in a particular field of science, engineering, social science or the humanities; b) evidence of a commitment to research involving the interaction of science, medicine, or engineering with society; c) a proposal of study and research for the fellowship year related to the Program's areas of research and teaching, which include:

- Social and Historical Studies of Science and Technology
- Technology and the Distribution of Power in Industrial Society
- Cultural Dimensions (e.g., ideological, aesthetic, ethical) of Science and Technology
- Policy Studies involving Science and Technology

Preference will be given to proposals involving substantial work in a field or area beyond the candidate's educational background. Application should be made in a letter consisting of no more than five double-spaced typed pages and a curriculum vitae. Additional material will be requested if necessary. PhD degree or equivalent desirable. PhD's at all levels of professional career are eligible. Partial or full stipend available. Appointments will commence in September, 1980. Address application to: Donald L.M. Blackmer, Director, STS Program, Bldg. 20D-213, M.I.T., Cambridge, MA 02139. Deadline for receipt of applications: January 15, 1980.

Science, Technology, & Human Values

announces that, beginning with the Fall 1979 issue, it will be co-sponsored by the Program in Science, Technology and Society at the Massachusetts Institute of Technology and the John F. Kennedy School of Government at Harvard University, and will be published by the M.I.T. Press. Founded in 1972 as the Newsletter of the Program on Public Conceptions of Science and now a quarterly review, Science, Technology, & Human Values publishes scholarly articles on: (1) Ethical problems and value conflicts generated by contemporary and historical developments in the natural and social sciences; (2) The impact of changing social values and current events on the conduct of science and technology, especially in regard to policy formation, research regulation, funding priorities and employment or educational opportunities; (3) Ethical problems and value conflicts that arise in the course of scientific research and technological development, including those encountered by scientists and engineers in their professional activities; (4) Public assessment of science and technology, including public images and attitudes, legislative actions, public scientific literacy, and citizen participation. All articles are refereed. Readers are encouraged to submit announcements of new programs and projects, curriculum development, conferences, calls for papers, employment opportunities and special publications to the News Section and Meetings Calendar. Book reviews and an annotated bibliography cover recent publications on science, technology, and society in both the sciences and the humanities. Annual subscription rates are $12.00 - individuals; $22.00 - institutions; and $10.00 - students and retired persons. Subscription department: M.I.T. Press Journals, 28 Carleton Street, Cambridge, MA 02142. Editorial Offices: Aiken Computation Laboratory 234, Harvard University, Cambridge, MA 02138.

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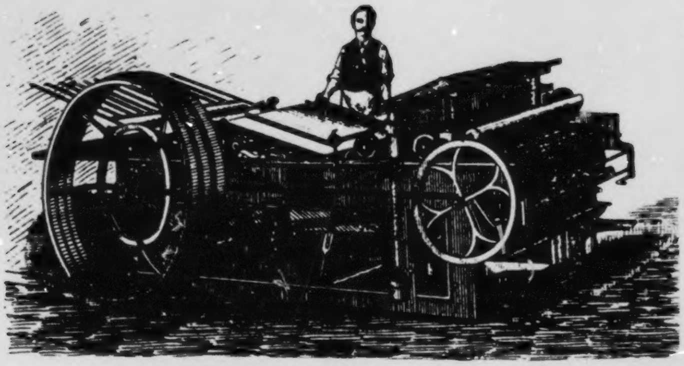

We noted in the October issue (see p. 15) that the STS Newsletter must become financially self-supporting if it is to continue publication. To that end we included a tear-sheet for you to return, requesting that you indicate your willingness or unwillingness to subscribe at the rate of $5.00 per year ($6.00 after July 1, 1980). While the number of responses and suggestions for improving the newsletter have been gratifying, we are still far short of the number needed (1,000 subscriptions) for us to continue publishing on the present basis. As indicated in the previous issue, we are only concerned with recovering our basic duplicating and mailing expenses which run to approximately $1.00 per copy for each twenty-page issue. Thus, if you would like to see the newsletter continue and are willing to subscribe yourself or perhaps have your library subscribe, please return the tear-sheet below. (Please do not send money at this time.)

Return to:

Dr. Stephen H. Cutcliffe
Editor, STS Newsletter
327 Maginnes Hall #9
Lehigh University
Bethlehem, PA 18015

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program

Director: Steven L. Goldman
Editor: Stephen H. Cutcliffe

Number 15
December 1979

TECHNOLOGY, FREEDOM AND INDIVIDUAL AUTONOMY

A number of claims for contemporary "high technology" are advanced by its proponents as self-evident truths. They claim:

- That technology, by nature, is a passive tool which may be used beneficially or harmfully; it itself embodies no values and is a morally neutral means to whatever ends are desired; it plays a strictly passive role with respect to issues of political power and social control.
- That contemporary technology enlarges human freedom, widens available options and enhances personal autonomy; whatever ill consequences result from the deployment or utilization of technology are caused by man exercising this enhanced freedom of choice.

"Surely," proclaims Simon Ramo, "everybody understands that science and technology are mere tools for civilized man."[1] "... if anyone is to blame, it is not the tool but the human maker and user," adds Peter Drucker.[2] The reason why we have smog in Los Angeles, says Alvin Weinberg, is because too many individuals autonomously drive cars! "Many people by their individual acts (which are presumed autonomous) cause shortages...."[3]

"The negative effects of technology ... are traceable ... much more to the autonomy that our political and economic institutions grant to individual decision-making," says Emmanuel Mesthene.[4] Why megalopolis? Because "... people apparently want to live together in large agglomerations ..." explains Melvin Kranzberg.[5] "However much we deplore our automobile culture, clearly it has been created by people making choices ..." says Samuel Florman.[6] And Daniel Moynihan proves it with a syllogism: "Freedom is choice and technology enhances choice. (Therefore,) technology has vastly enhanced human freedom."[7]

It should be evident that the two major propositions -- that technology is passive and neutral, on the one hand, and that it enhances human freedom and autonomy, on the other -- are incompatible and mutually exclusive. If technology is neutral, how can it be biased toward freedom? And if it plays an active role with respect to *one* moral issue (freedom), then is it possible to claim that technology is neutral toward other ends? Notwithstanding the contradiction, the same individuals who make the one claim often also make the second one.

But quite apart from this logical fallacy, even if both claims together cannot be true, perhaps one or the other is valid. In order to judge, it is important to understand the fundamental nature of contemporary technology. One-dimensional observations -- as of the proverbial elephant -- are inadequate to describe this multidimensional abstract concept. The dimensions or elements of technology might be classified as follows.

1. *Physical objects* - hardware - tools, instruments, machines, weapons, appliances. This is the original, elementary conception of technology.
2. *Knowledge* - not abstract, scientific knowlege but *know-how* - methods, processes, *technique*. For Harvey Brooks, this dimension *is* technology.
3. *Human beings* - not autonomous individuals but people who are largely interchangeable with one another - have the appropriate know-how to operate the hardware.
4. *Organization and system* - the organized structures, the integrated networks within which the hardware is embedded and technique employed; the linkages that tie together the hardware and the technique with the social institutions.
5. *Political and economic power* - this dimension is implicit in the preceding one but it should be acknowledged explicitly.

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Technology is not simply the computer, for example, but large-scale computer networks linked through telecommunications systems; it is computer operating and managing systems; it is data banks, the know-how and the programs to manipulate them and the power implicit in controlling them. Any analysis of contemporary technological society which fails to account for this multidimensional nature of technology -- especially the notion of technological system -- will be deeply flawed.

In this light, how can we interpret the preceding technological litany? Do these claims help to explain reality or do they create illusion? Do they provide an accurate description of contemporary technological society -- as a science is descriptive? Is it "man" in the abstract who is the culprit, or more specific agents? Does not somebody's profit enter the picture at all? Is the nature of technology independent of the social order?

It is my contention that neither the technology-is-neutral claim nor the technology-enhances-freedom claim is tenable. Furthermore, a strong case can be made that the assertions purporting to explain the nature of technology contain a large dose of ideology. They serve the instrumental function of image-making, of inducing people to behave *as if* the ills experienced by society are consequences of objective decisions carried out for such objective reasons as efficiency. By failing to take political power and economic interests into account they conceal the existence of specific powerful corporations whose activities in pursuit of their interests are major determining factors of the ills ascribed by the ideology to the exercise of individual autonomy.

It is almost universally accepted that technological innovations in production processes and in products serve such objective goals as efficiency, increase in productivity, and human needs satisfaction. Nevertheless, there is a small, but increasing, body of literature which challenges this perception. For example, David Dickson concludes from his study of the development of the textile industry in Britain during the Industrial Revolution that the organization of work in factories and the introduction of many of the machines utilized in the textile industry were carried out -- not so much for technological reasons -- but largely for the managerial reasons of subduing and disciplining the workers; not so much for production efficiency as to maintain authoritarian forms of discipline, hierarchical structure and regimentation.[8] Richard Edwards reaches similar conclusions about the complex hierarchy of the modern large corporation.[9] David Noble of the Program in Science, Technology and Society at MIT shows how such a modern innovation as numerical control of machine tools is implemented in the U.S. in such a way as to remove control over the work from the skilled machinist.[10]

Most contemporary innovations arise from R&D activities carried out in the labs of technology-intensive corporations. The goals of these corporations are growth in sales and in profits. Product innovation -- no less than any other activities of the corporation -- serves corporate purposes and would be carried out quite independent of any existing human or social needs. It would not do for the lack of a need to thwart the corporation's desire to increase sales and profits.

There are several arenas in which human beings are presumed to exercise their freedom of choice and thus influence the development of technology. They are: the workplace, the market, the voting booth. That is, people are involved as producer, as consumer, and as participant in the political process. Let us briefly examine each of these areas.

It makes no sense to imagine an employee -- one of a vast number of others -- as exercising autonomy in the workplace; as using presumably neutral technology for his/her own desired purposes. (The absurdity of the notion has been clearly described by Langdon Winner.)[11]

As for the political arena, there is at best a tenuous relation between a citizen's exercise of the franchise and the deployment of technology. The configuration of any segment of technology as it now exists is not the consequence of open political debate on the merits of alternatives and then selection through the political process.

Political scientist James Carroll has provided some useful insight here. "Technological processes," he says, "frequently are the *de facto* locus of political choices .... In the absence of appropriately structured political processes for identifying and debating the value choices in what appear to be technical alternatives, technical processes become, by default, the locus of political value decisions."[12] These choices, says Carroll, are binding on individuals and groups, and they may have no immediate recourse from them.

Finally, the market. The image of the market as a neutral, objective determinant of social choice is a powerful shaper of the consciousness of Americans as autonomous choosers among many options. There are a number of things wrong with this image. One is the skewed asymmetry as between individuals and large, powerful corporations. Another is that individuals have become highly dependent on the technological systems that define the conditions of contemporary life: transportation systems, food production and distribution systems, energy systems, artifact production systems, health-care systems, communication systems, etc. For most people there is no alternative to utilizing these systems -- unless they drop out of society altogether. They are hooked on these systems and cannot detach themselves. It is estimated, for example, that low income families now spend 30% of their income on energy cost and this ratio will increase in the 1980's. They can either eat and freeze or heat and starve this winter -- clearly not by choice.

But even within the context of the regulation of technological developments by the market, is it possible to describe accurately the current status of specific technologies (e.g. the transportation system) as the consequence of untrammelled individual choice guiding the invisible hand? Market prices can be kept artificially low by transferring some of the costs associated with production or use from the manufacturer and/or user to third parties in at least two ways:

(a) by subsidies from the government.

(b) by failure to account for "external costs" in setting prices.

In actual fact, both of these processes have operated widely to distort price structures. Vast sums have been transferred to corporations in subsidies by the federal government, either directly (through grants and low-interest loans or loan guarantees) or indirectly (through the taxing mechanism or by having the government assume responsibility for certain components of technological systems, like highways and airports). Similarly, inestimably huge external costs, both privately borne and socially borne, have been transferred to others. Purchasing decisions are obviously influenced by prices that are artificially depressed in such ways. If this circumstance permits a large-scale technological development to take place, which then induces major changes in the way people live, would it be meaningful to assert that the detailed forms of the resulting society are consequences of individual "free choice"?

An often-used illustration by the arguers for free choice is the transportation system. "The love affair of Americans with their cars" is an image commonly used to explain our automobile culture. In this era of fuel shortage, it is customary for American leaders to exhort the people to conserve gasoline by driving less. The implication is clear that driving by Americans is discretionary and it is only the perverse exercise of individual free choice that causes our current ills. But do individuals really have any choice? True, they can select this model car or that, this color or that, this upholstery or that -- but most people cannot choose not to have a car. The design of cities, the locations of services, places of employment, shopping centers, etc. are all predicated on the motor car as the dominant mode of transportation. These conditions induce an institutionalized style of living over which individuals have little control and to which they are compelled to conform.

The reason for smog in los Angeles, says Weinberg, is that too many people drive cars. A much more accurate reason is that General Motors bought the Pacific Electric Railway System and destroyed it in order to promote the use of the private automobile.[13] (During the 1920's the PER operated 1200 miles of interurban rail service. When the population of the area was only 1 million in 1924, the system carried a volume of 109 million passengers. By comparison, almost half a century later when the population was 800-900 per cent greater, public transit using buses carried only 75 per cent more passengers.) Not individual autonomy but the technological order, capped by the power of large corporations, is the major cause, not only for smog but for the fact that over half the land area of Los Angeles -- including freeways, streets, driveways, parking lots, gas stations, auto show rooms, etc. -- is dedicated to the automobile.

To conclude:

From the analysis presented in this brief essay, it is clear that the nature of contemporary technology reflects the dominant ways in which reality is interpreted in society. It is not independent of issues of economic and political power and social control. A society in which rapid economic growth is a high value necessitates a particular kind of technology; namely, one with a high level of innovation, quite independent of social need. Policies leading to economic expansion *have to be* reflected in the particular form of technology through which this expansion is achieved. Hierarchical forms of social control become reflected in the technology. Thus, large-scale, complex, interconnected technological systems require hierarchical structure for their routine operations. The presumed neutrality of technology then lends legitimacy to hierarchical structure and to any policies required to maintain them, however repressive and inimical to the public good these policies might be, for example, the recently proposed Energy Mobilization Board.

Contemporary technology has outdistanced its simple, neutral-tool, liberating image. In its present pervasive, all-encompassing form, far from expanding human freedom, contemporary technology limits individual autonomy; it imposes conditions of life and a style of living concerning which individuals have very little choice. To chide individuals for recalcitrance or perversity for their unwillingness "to give up" their refrigerator or automobile is to profoundly misjudge the nature of contemporary technology. It is like blaming the victim for the crime. Public policies resulting from such misperceptions -- such as the recently proposed synfuels program -- will deepen the pathology; they will lead to increased centralization and hierarchy and a further reduction of human autonomy.

Values are central in the configuration and structure of technology. The contemporary "advanced", highly-structured, centralized, inflexible, all-pervasive form of technology is incompatible with individual autonomy and human freedom. If the latter are truly valued ends, then it is essential that forms of technology with different characteristics compatible with these values by developed. A first step is the explicit placing of value issues up-front in the debate on technology.

° Norman Balabanian
Engineering and Public Affairs
Syracuse University

FOOTNOTES

1. Simon Ramo, *Century of Mismatch.* (New York: David McKay, 1970), vi.
2. Peter F. Drucker, "Technological Trends in the Twentieth Century," in Melvin Kranzberg and Carroll Pursell, eds. *Technology in Western Civilization.* 2 vols. (New York: Oxford, 1967), II, 32-33.
3. Alvin Weinberg, "Can Technology Replace Social Engineering?", *University of Chicago Magazine*, 59 (October 1966). Reprinted in Albert H. Teich, ed. *Technology and Man's Future.* (New York: St. Martin's Press, 1977), 22-30.
4. Emmanuel G. Methene, *Technological Change: Its Impact on Man and Society.* (Cambridge: Harvard University Press, 1970), 40.
5. Kranzberg and Pursell, eds., *Technology in Western Civilization*, II, 700.
6. Samuel C. Florman, *The Existential Pleasures of Engineering.* (New York: St. Martin's Press, 1976), 60.
7. Daniel F. Moynihan, Honors Convocation Lecture, Syracuse University, Reported in Syracuse University *Record*, February 1, 1979, p. 3.
8. David Dickson, *The Politics of Alternative Technology.* (New York: Universe Books, 1974).
9. Richard C. Edwards, *Contested Terrain: The Transformation of the Workplace in the 20th Century.* (New York: Basic Books, 1979).
10. David Noble, "Social Choice in Machine Design: The Case of Automatically Controlled Machine Tools," in Andrew Zimbalist, ed. *Case Studies in the Labor Process.* (New York: Monthly Review Press, 1979).
11. Langdon Winner, *Autonomous Technology.* (Cambridge: MIT Press, 1977), 201. (This book deals with many of the issues treated in this paper.)
12. James D. Carroll, "Participatory Technology," *Science*, 171 (February 19, 1971): 647-653. Reprinted in Teich, ed. *Technology and Man's Future*, 336-54.
13. Bradford C. Snell, *American Ground Transport*, 1974. Prepared for the Senate Antitrust Subcommittee.

REPORT OF A CONFERENCE
AT WINGSPREAD CENTER
ON HUMANITIES AND TECHNOLOGY

In February, 1979 fellows of the National Endowment for the Humanities Institute (at the University of Chicago) met with faculty from the University of Wisconsin-Green Bay at a round table conference at the Wingspread Center in Racine, WI to discuss the general topic Humanities and Technology. The work occupied the better part of two days divided into three meetings with a special focus for each. The meetings began with an introduction and discussion of some reading appropriate to the topic. The subjects of the meetings were:

1. What models exist for the humanistic study of technology?
2. Do the humanities require new departures, procedures and categories for this study?
3. What are the prospects for developing a general framework for the humanistic study of technology?

The participants offered a number of models for the study of technology usually based on their own particular interests. These were diverse and included the model of control and losing control; the study of technology as a social artifact; the conflict between humanities and technology as one between conflicting world views especially between an organic as opposed to a mechanistic view, or a mystical as opposed to a mechanistic view; and, finally, the study of technology as a source of mundane power.

In general the models expressed agreed with the perspective that technology was embedded in culture and that the possibility of establishing a common framework for studying it existed although approaches might vary considerably. But the possibility that science and technology would become more organic and less mechanistic in their procedures was strongly denied, especially by non-humanists. We were later to realize that this denial implied special responsibilities for humanists.

The second session began with a discussion of Leon R. Kass"'Making Babies' Revisited," The Public Interest (Winter 1979): 32-60, which all the participants had previously read. The principle discussant of the article, a mathematician, stressed that the issue, the validity of carrying out experiments on blastocysts (3-6 day old embryos) which may have as their goal the relief of infertility, was entirely technological since the goal was not improved scientific information, otherwise the experiments might as well have been undertaken with animal tissues.

The participants readily agreed that Kass' essay was a true humanistic effort but, as the discussion developed, they became increasingly consistent in their criticism of Kass because he had established no objective standards. The humanists were additionally critical, it seemed, because they believed that humanists should clarify issues or raise problems rather than try to solve problems. Others emphasized that it is with decisions that humanists must be occupied primarily, otherwise scientists and technologists will make the decisions and do so on a mechanistic or reductionist basis. They asked, "Isn't it possible to describe dehumanized behavior or establish standards which will bracket technological choice on some humanistic continuum between good and bad?" Several humanists expressed doubt about this possibility.

Drawing on the consensus established in the first session, that technology was embedded in culture, some humanists questioned their society which would not provide the basis to allow them to appeal to shared values; a society in which they could not form any idea of the ideals to which humanists should aspire, i.e. to greater objectivity. Others argued that many of the standard procedures of academic humanists were addressing the ethical issues of technology and society in courses, etc. Still others seemed to feel that in the present situation there was more at stake than educational goals; that some kind of direct interface between humanities and technology should exist, but whether in the academy or elsewhere, they did not say. Discussion followed in regard to the urgency of developing an interface between the humanities and technology with the humanists generally arguing that, together with other institutions, academia was contributing to an improved ability of society to evaluate and assimilate technology.

Session Three began with a discussion of Hans Jonas, "Technology and Responsibility," Philosophical Essays (Prentice-Hall, 1974): 3-20, but turned into one dominated by the model, mentioned in Session One, of technology and the power relationships of society, especially the manipulation of technology for corporate ends. In this context, it was observed that the moralistic or individualistic approach would have a limited effect on technology since the decisions in any case would tend to benefit the corporation. Looking at it in this way would tend to take the burden off the individual.

But can the corporation and the economic and social values it represents be controlled except by individual decisions? Does not the issue necessarily come down to the courage of individual decision-makers, others asked? And does not that imply the development of some models for evaluating and making alternative choices. Otherwise the reductionist model will prevail, some feared.

The session closed with an expression of the view that humanists with others should be involved in the decision-making process: ". . . . let's get around to human beings who are intelligent and willing to talk about issues."

--Dr. Paul P. Abrahams
Department of History
University of Wisconsin-
Green Bay

For further information on the conference or a list of participants, please write directly to Dr. Abrahams.

* * *

CORRECTION

In the #13, October 1979 issue, Gerald Holton's *Thematic Origins of Scientific Thought* (Harvard) was referred to as an "expensive paperback," (p. 3). The price of Holton's book was inadvertently confused with that of another volume. The correct price for the paperback version is $5.95. *Editor*

PHILOSOPHY AND TECHNOLOGY

An experimental course entitled "Philosophy and Technology" was offered by two philosophers and a chemical engineer at Ohio University during the Spring quarter of 1979. Development of this course was made possible by a grant from the National Endowment for the Humanities under a project directed by Professor Donald Borchert of the Department of Philosophy. Professor David Stewart, also a member of the philosophy faculty, and Professor Nicholas Dinos, Chairman of the Department of Chemical Engineering, were the other participants in this team-teaching effort.

The course was cross-listed in both the philosophy and chemical engineering departments and was also unusual in that it was a cross-disciplinary effort spanning two distinct colleges within the university. Another distinctive aspect of the course was a Field Trip to three-technology intensive industries--a petro-chemical plant, a consumer-products firm, and a steel mill. These were selected to reveal a wide diversity against a background of similarities in contemporary industrial technology.

Twenty-seven students were enrolled in the course, with their numbers about equally divided between engineering and humanities students. The course met twice a week in the evenings for two and one-half hours, and the usual format was a 50-75 minute lecture followed by a discussion among the three professors. The overall aims of the course were to assist students in understanding the nature of the engineering/technological enterprise and to develop a philosophical posture from which to assess the value systems served by technology.

The course proceeded according to the following syllabus:

Philosophy and Technology
Call No. 1489 Ch.E. 490
4620 Ch.E. 490
4565 Phil. 369E

Spring Quarter 1979
Prof. Donald M. Borchert
Prof. Nicholas Dinos
Prof. J. David Stewart

Objective of the Course

This course will attempt:

(1) to explore the conceptual frameworks associated with developing technology;
(2) to achieve an understanding of how engineers pursue their enterprise;
(3) to develop a reasoned assessment of technological development.

Textbooks to be purchased

Jacques Ellul, *The Technological Society*. New York: Vintage Books, 1964.
Samuel C. Florman, *The Existential Pleasures of Engineering*. New York: St. Martin's Press, 1976.
Lewis Mumford, *Technics and Civilization*. New York: Harcourt, Brace & World, 1963.
Charles Susskind, *Understanding Technology*. Baltimore: Johns Hopkins University Press, 1975.
Alfred North Whitehead, *Science and the Modern World*. New York: Mentor Book, 1925.

Part I: The Conceptual Frameworks Associated with Developing Technology,
moderated by Dr. J. David Stewart.

Reading Assignments: Lewis Mumford, *Technics and Civilization* (in part).
Alfred North Whitehead, *Science and the Modern World* (in part).

Session #1 (March 29) - Eight contemporary definitions of technology were critiqued, and the lecturer offered his own definition for discussion. The nature of philosophy as a discipline was examined.

Session #2 (April 2) - The conceptual contribution of the Greeks to the development of science and technology was discussed in terms of
(1) the power of abstraction,
(2) the view that changes in quantity can generate changes in quality,
(3) the notion of the rationality of nature,
(4) the notion of the quantifiability of nature, and
(5) the development of logic.

Session #3 (April 5) - Whitehead's suggestion that a "sleep of reason" prevailed from the time of the Greeks to the modern era (17th century) was examined. Four factors were suggested to account for the awakening of reason and the mushrooming of science and technology:
(1) the desacralization of nature,
(2) the growth of an experimental attitude,
(3) the development of inductive reasoning,
(4) the belief that knowledge is power.

Session #4 (April 9) - The "machinification" of human thought and action with the attendant subversion of the human cogito during the 17th and 18th centuries was examined.

Session #5 (April 12) - The 19th century romantic reaction to machinification was explored particularly with reference to Kierkegaard and Nietzsche. The continuation of this reaction in 10th century existentialism was also discussed especially in the thought of Sartre and Marcel. Parallels to these movements were explored in the music of Bach, Mozart, Beethovan, Wagner, and modern jazz.

Session #6 (April 16) - Examination No. 1 covering Part I of the course was given. The test lasted 75 minutes, after which the movie "The Man in the White Suit" starring Alec Guiness was shown to enhance appreciation both for the engineer's delight in technological development and also for the unexpected mixture of good and evil which frequently attends technological advance.

Part II: Engineering Methods and Paradigms,
moderated by Dr. Nicholas Dinos

Reading Assignments: Charles Susskind, *Understanding Technology* (in part).
Samuel C. Florman, *The Existential Pleasures of Engineering* (in part).

Session #1 (April 19) - The engineering enterprise was depicted as limited by three sets of constraints: the possible, the probable, the feasible. The possible over-against the impossible was discussed in terms of the three laws of thermodynamics.

Session #2 (April 23) - The second major constraint under which the engineer works -- the probable over-against the improbable -- was elucidated by discussing the mathematical models which engineers use to identify probably successful projects within the sphere of possible projects. In this connection, a brief historical survey of applied mathematics was presented, the distinction between linear and non-linear systems was explored, and the nature of computers was examined.

Session #3 (April 26) - The attitudinal, sociological, philosophical and scientific presuppositions of a "typical" engineer were suggested and discussed. Those presuppositions were explored further in a role-playing scenario in which Stewart adopted the position of a right-wing capitalist, Borchert assumed the stance of a left-wing Marxist, and Dinos acted as a middle-of-the-road "typical" engineer.

Session #4 (April 30) - The third major constraint for engineers -- the feasible over-against the non-feasible -- was discussed in terms of economics to give an analysis whose goal is not a perfect solution but rather an optimal solution.

Session #5 (May 3) - The engineer's acceptance of the physicist's stochastic, indeterminate universe was juxtaposed to the common engineering practice which depends upon a deterministic, causal universe. The puzzles and problems associated with this situation were explored.

Session #6 (May 7) - Examination No. 2 covering Part II of the course was given. The test lasted 75 minutes, after which the movie "Citizen Kane" starring Orson Welles was shown to illustrate the corrupting influence of unrestrained power by which the good can be transformed into evil.

Part III: Philosophical Assessments of Technology,
moderated by Dr. Donald M. Borchert

Reading Assignments: Lynn White, Jr., *The Historical Roots of Our Ecological Crisis*
Harvey Cox, *The Secular City* (in part).
Karl Marx, *The Economic and Philosophic Manuscripts of 1844* (in part).
Jacques Ellul, *The Technological Society* (in part).
Samuel Florman, *The Existential Pleasures of Engineering* (in part).

Session #1 (May 14)- The debate between ethical relativism and ethical absolutism was explored, and the position that the philosophical evaluation of technology presupposes a rejection of ethical relativism and the adoption of a set of norms against which to critique technology was suggested.

Session #2 (May 21) - Models of humanness from the religious and intellectual heritage of the West were generated as a position from which to evaluate technology. The relation of technology to the biblical perspective was examined and the positions of White and Cox were critiqued.

Session #3 (May 24) - Technology was presented as a human activity that participates in the strange ambiguity of human freedom: humanizing activities often yield unintended dehumanizing consequences. Marx's view of technology and alienation was discussed.

Session #4 (May 31) - Ellul's assessment of technology was elucidated and Florman's critique of Ellul was reviewed and evaluated.

Session #5 (June 6) - Examination No. 3 covering Part III of the course and the Final Examination involving a comprehensive question were given.

The Field Trip (May 17-18)

To enhance understanding of a variety of technologies the class and instructors toured the DuPont polymer plant in Washington, W.Va. (an example of a high technology petro-chemical plant), the Proctor and Gamble Ivorydale plant in Cincinnati (an example of a medium technology consumer-products oriented firm), and the Armco steel mill in Middletown, Ohio (a basic heavy industry, capital-intensive technology). These sites were carefully selected to reveal a wide diversity against a background of similarities in contemporary industrial technology.

Internal and external evaluation indicated the course was successful in achieving its stated goals although, as is normally the case with experimental courses, a certain amount of fine-tuning will take place when the course is offered a second time during the Spring quarter 1980. Specific recommendations included:

(1) Textbooks: Whitehead was too obtuse and must be deleted. Susskind does not portray adequately engineering modeling and must be replaced. Ellul, though difficult, may be retained because of its seminal nature. Mumford and Florman were eminently readable and pedagogically useful, and would be retained. Marx would be retained, although difficult; and White and Cox might be retained as representatives of an important, but somewhat dated, debate.

(2) Part I: The Greek background (session #2) would be condensed and the discussion of 17th and 18th century developments would be enlarged (sessions #3 and #4).

(3) Part II: The analysis of the probable over-against the improbable would be strengthened by a clearer presentation of mathematical modeling and linear versus non-linear systems (session #2). Also, the laws of thermodynamics would be given additional clarification (session #1).

(4) Part III: The debate between relativism and absolutism would be condensed (session #1) and more time would be given to "developmental ethical absolutism" and to the critique of major philosophical assessments of technology (sessions #2, #3, and #4).

(5) The Field Trip: The travel time must be reduced by eliminating the Cincinnati segment of the trip and substituting similar site visitations in the Ashland, Kentucky/Huntington, W.Va. area. In addition, more post-trip time should be devoted to formal class discussion of the sites visited.

(6) Films: The film "Citizen Kane" seemed to fail as a pedagogical device whereas "The Man in the White Suit" seemed to be a winner. Accordingly, "Citizen Kane" should be replaced with a film such as "Bridge on the River Kwai" starring Alex Guiness in which the engineer's fascination for his enterprise carries him beyond concern for the moral struggles associated with war.

Persons desiring further information on the course should write to Professor Donald Borchert, Dept. of Philosophy, Ohio University, Athens, Ohio 45701.

LEM'S LUNATIC ROBOTS: CHARTING *THE CYBERIAD*

Introducing Stanislaw Lem, the little-known Polish science fiction writer! I have been intrigued by Lem ever since I read he had the temerity to *complain* that Isaac Asimov's three-lawed robots were "doomed to goodness," but his fiction has not been readily available in English until quite recently. Now that I have taught *The Cyberiad: Fables For The Cybernetic Age* (New York: Avon, 1976), I would like to report the near tumultuous response it evoked. And I have got to think that any book beginning "One day Trurl the constructor put together a machine that could create anything starting with n." will interest readers of STS.

Mankind in the *Cyberiad* is a memory, a myth, maybe even make-believe ("the Missing Clink"). The universe is inhabited by robots, and Lem's heroes are two knight-like constructors, Trurl and Klaupaucius, who have just received their Diploma of Perpetual Omnipotence, who can "kindle or extinquish suns as easily as shelling peas," and who "sally forth" to bring to distant lands the benefit of their expertise. Gawain and Lancelot must be rending their mail, however, for these cyberknights are a pungent mixture of Bugs Bunny, the Road Runner, Wile E. Coyote, the Three Stooges, Rube Goldberg, Jean Tinguely, and Monty Python --oh my yes, definitely Monty Python! While most science fiction writers solemnly humanize their robots, Lem humorizes them. Humor --antic and frantic, sick and slapstick, linguistic, ironic, always satiric-- is both the fuel and the fruit of the *Cyberiad*.

Let me chart the territory for you by dividing the fifteen stories into four, not mutually exclusive categories. First, the clear morals of several stories signal the didactic function of traditional fables. Aesop stands behind such lessons as *think before you speak, he who laughs last, laughs best*, and *love conquers all* in "How the World Was Saved," "A Good Shellacking," and "How Trurl Built a Femfatalatron." Lem's use of robots instead of animals, his substitution of the world of technology for the world of Nature as the didactic vehicle, however, surprises by suggesting our relationship with a mechanistic moral order. But Lem's lunacy almost shades the traditional form completely. The didactic punctuation does not dominate the story as it usually does in the fable. In the first story mentioned above the "machine that could create anything starting with n." (and that includes, alas, "dynamic, agressive Nothingness") rearranges natural order, causing comic juxtapositions, by substituting linguistic relationships for physical ones. The second story is based on a broad pun: *disassembling* the Machine to Grant Your Every Wish permits the *dissembling* which enables Trurl to triumph. In the third, Lem's language play takes over. The constructor hired to kill Cupid sees the Prince's love for Cybernella through the scientific jargon of "enamorization" and "unrequited amatorial superfixation," conceives of his task as "decaptivation" and "disenamorment," and concocts an (unsuccessful) femfatalatron replete with concupiscence coefficients, ardor dampers, alternating tantalators, and volupticles, which is powered by lascivicity measured in megamors and kilocupids.

Secondly, there are several stories in which Lem seems to be consciously invigorating such science fiction cliches as Frankenstein ("Trurl's Machine"), personality transfer ("The Mischief of King Balerion"), robot soldiers ("The Trap of Gargantius"), robot poets ("Trurl's Electronic Bard"), and robot toys ("The Offer of King Krool"). In contrast to Shelley's eight foot humanoid, for instance, Lem's Frankenstein is a sensitive eight story computer which rips itself off its foundation and thrashes about the countryside after Trurl and Klaupaucius insult it for declaring, over and over again, that two plus two is seven. Precisely because it is so basic, this comic math error threatens the whole rational order, and it takes an act of Nature to protect the two robots from the monster's hulking wrath. The constructors "solve" the natural desires of King Ferocitus and King Atrocitus for the perfect army, an army that literally functions as one man, by inserting a plug in the front and a socket in the back of each soldier. With unity, however, also comes increased wisdom, a wisdom directly proportioned to the numbers involved, which turns fighters into philosophers. Thus, instead of a battle plan there is a painting of battlements; shock trooops and a firing squad write a sonnet entitled "On the Mystery of Being" while on guard duty; and the Eightieth Marlabardian Corps" maintained that the whole concept of 'enemy' needed to be more clearly defined, as it was full of logical contradictions and might even be meaningless."

A third kind of story, the best in the *Cyberiad* I think, presents new insights into such things as the mythos of science, bureaucracy, and the information explosion rather than invigorating older formulas. In "The Dragons of Probability" Lem hits at the abstraction of science, its divorce from reality, through the School of Higher Neantical Nillity, which delights in examining non-phenomenon empirically. One analyst discovers three kinds of dragon, each of which non-exists in an entirely different way, and then the invention of a probability amplifier provokes a plague of real dragons on peasants with cockney accents, necessitating dragon fighters armed with dragon dampers and dragon repellent. The machine based paradise of the Suess-like Steelypips ("We are the Steelypips, we have no fear, no spats in our vats, no rules, no schools, no gloom, no evil influence of the moon, for we have a machine, with springs and gears and perfect in every respect") is threatened by an intruder (a "that") as passive as Poe's Raven. "Trurl's Prescription" is to set up an office, create law, establish a bureaucracy replete with unacceptable forms, undecipherable rules, and illegible signatures, to treat the alien as normal, kill it with paperwork, and finally revoke its lease. "Pirate Pugg" is a pirate with a Ph.D. who steals only information, echoing white-collar crime, and whose great weapon is a menacing whistle. As punishment for his inordinate thirst for knowledge, Pugg is chained to a metainformationator and mentally crushed by an eternal avalanche of (useless) facts: all the words that rhyme with spinach, the thoughts of unmarried whales getting on in years, six ways to cook cream of wheat, the cloacal diameter of the tufted twit, the size of bedroom slippers on Cob....

The last four stories in the *Cyberiad* all deal with the search for perfection, and are characterized generally by a grimmer, more serious tone. On Legaria Trurl interrupts an angry mob in their daily ritual of resurrecting and then murdering the scientist Malaputz, whose revolutionary utopian theory of substituting electrical connection in series for that in parallel caused general "malaputzment" everywhere. "Take that for the Prophecy of Happiness! And have that for the Bed of Roses, and that for the Bowl of Cherries!" they chant as they rip Malaputz to pieces. Trurl tries to stop the carnage, but when he learns the scientist has learned nothing from his experience, that he has "an entirely new formula" for perfect bliss, "foolproof" this time, he permits the re-murder. Beware of scientists bearing gifts! Dark humor, indeed! And the trip to the land of Highest Possible Level of Development is a surreal nightmare. One H.P.L.D. has penny whistles for eyes, thuribles for ears, wears orchid pantaloons, high heels, and eats a gingerbread mandolin. Another has a bell-shaped head, three horns, and carries a jewelled pillow. A third has ears that flit like butterflies, hostile eyes in numerous moles on his cheeks, and holes filled with raspberry jam on his chest. A fourth picks his own nose as his face lays on his knees. These abominations have failed 64,513 times, most notably with 300 hunchbacks, to help others. The clear message is that no civilization can be helped, no revolution can change things. The humor turns skeletal. Just as Trurl's stories are stories within Lem's story, what if Lem's story --our reality-- is just a story in a higher story? What if, like Mymosh the Selfbegotten, we are just a consciousness accidentally sparked into temporary vigor by an accidental concurrence of a kitchen jug, shoe, and bird dung in the mud puddle of a trash heap along some forgotten rural route at the edge of the universe? What if we are not the makers of fun but the objects of fun, not the shapers of humor but the subjects of humor? Whew, as Emily Dickinson said, would not the jest have crawled too far?

This four part map of *The Cyberiad* hardly does justice to either Lem's virtuosity or versatility, but it should help you get started. Patricia Warrick provides a helpful context for studying the *Cyberiad* when she suggests that "the machine must be made laughable rather than threatening if man is to learn to live constructively with it," that we need a new mythology in which the machine is a buffoon rather than a bugaboo. Lem, who has written a major, but as yet untranslated, work entitled the *Summa Technologiae*, does indeed seem to be engaged in such new myth making. More revealing, though, is this following statement about the life of inanimate objects from Lem's autobiography: "To this day I have a special feeling for all sorts of broken bells, alarm clocks, old coils, telephone speakers and in general for things derailed...used up, homeless, discarded.... I used to be a philanthropist to old spark plugs, I would buy... fragments of incomprehensible gadgets... I would turn some crank or other to give it pleasure, then put it away again with solicitude." Simply put, Lem has a warm feeling for machines, and to me, whose cellar is a modern day elephant's graveyard, where Emerson television sets, Philco refrigerators, and Westinghouse fans have crawled to die, enriching my whimsy with their technological tusks, that is a joy.

And I haven't even told you about Lem's other works available in English translations: the planet where people believe that water is their natural element in *The Star Diaries*, the benignimizers and the chemocrats of *The Futurological Congress*, the cybernetic espionage center of *Memoirs Found in a Bathtub*, Sciss the statistician in *The Investigation*, the fly-like mechanisms of *The Invincible*, the colloidal sea of *Solaris* . . . .

° Edward J. Gallagher
Dept. of English
Lehigh University

Rosenberg, Nathan and Vincenti, Walter G.
The Britannia Bridge: The Generation and Diffusion of Technological Knowledge.
Cambridge, Mass.: The MIT Press, 1978.
107 p. Ill., map.

In a monographic case study, Rosenberg, an economic historian, and Vincenti, an engineer, combine as the subtitle suggests to present an understanding of the development of technological knowledge and its subsequent diffusion to other spheres of technological activity. The Britannia Bridge, a wrought-iron tubular railway bridge completed in the year 1850, was erected to span the Menai Straits in Northwest Wales. The new knowledge of materials and design acquired in surmounting problems of government limitations on traditional building materials and minimum height requirements would ultimately be found to have applications in ships, cranes, machine tools, and commercial building generally. Within their broad belief that technological change can be viewed as "problem-solving activity," the authors suggest that the Britannia Bridge experience may serve as "a paradigm for a much larger class of events that collectively make up the historical process of industrialization."

This is the tenth volume in a series of monographs in the history of technology and culture published jointly by the Society for the History of Technology and The MIT Press. Rosenberg and Vincenti have produced an excellent piece of work which could very easily be incorporated into a history of technology course concerned with the nature of invention, innovation, and the transfer of technological knowledge, or perhaps a course designed to expose non-engineering students to the kinds of political, economic, and social as well as technical considerations which engineers face in design decisions. The book is well-illustrated with contemporary paintings and engineering drawings making the text readily understandable. The authors have also included a separate, fold-out facsimile of an 1851 map of British railways. Don't miss this little gem.

SHC, *Editor*

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BIGGINS, DAVID R. "SCIENTIFIC KNOWLEDGE AND VALUES: IMPERATIVES IN ECOLOGY." ETHICS IN SCIENCE AND MEDICINE 6, NO. 1 (1979): 49-57.

The confrontation of knowledge and values evident in philosophical discussions of ecology demonstrates the inadequacy of the general model of knowledge upon which investigation is still based. The central current of Western epistemology sees the social role of science as the practical mastery and manipulation of nature for human survival. As a result, scientific knowledge concentrates on "formal and efficient causes" rather than considerations of "purpose or teleology." The values which can be interpreted from our understanding of nature are thus limited by emphases on certain aspects of nature and deemphasis of others. Biggins suggests a beginning toward the resolution of this problem in the writings of Habermas and Marcuse.

BOZEMEN, BARRY, AND ROSSINI, FREDERICK A. "TECHNOLOGY ASSESSMENT AND POLITICAL DECISION-MAKING." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 15 (SEPTEMBER 1979): 25-35.

While largely an activity undertaken by the research community, technology assessment is requested, funded and controlled by bureaucratic agencies. Like other research, TA derives its legitimacy from logic and reason; in contrast, the source of legitimacy for bureaucratic agencies is political. The authors raise the question of how TA and bureaucratic decision making can accommodate one another without compromising their distinctive norms and values. To that end, Allison's three decision making models are discussed in the context of TA and bureaucratic processes. The "Rational Actor" model utilizes a technology assessment as the best possible information that determines the best possible decision. In the "Bureaucratic Politics" model, a technology assessment becomes a political weapon to be used or discarded according to the situation, while in the "Organizational Process" model, TA is a routine, intrinsic part of daily activities. Taken together, the models illuminate the persuasive power of information generated by research, the impact of values and interests on the end use of such information, and the incremental nature of bureaucratic action. All three models are thus required to depict the complex interaction between the political and scientific communities that characterizes technology assessment efforts.

BYRNE, EDWARD. "TECHNOLOGY AND HUMAN EXISTENCE." SOUTHWESTERN JOURNAL OF PHILOSOPHY 10 (NO. 1, 1979): 55-69.

By some anthropologists, the development of machines has been interpreted as part of the natural as well as cultural evolution of human beings. Following this view, "technophiles" have tended to depict the machine as an extension of the human nervous system, a prosthesis to overcome human physical limitations. Opponents to technology, Byrne observes, typically view it as a cultural, but not a natural force, essentially distinct from man, and perhaps even beyond man's control. Byrne contends that man and machine are not becoming one, arguing that the human being who neglects the cultivation of mind and body because a machine can do things better is not enhanced by that machine. Given the choice, he concludes, "people would rather do for themselves."

GAY, RUTH. "THE MACHINE IN THE LIBRARY." AMERICAN SCHOLAR 49 (WINTER 1979-80): 66-77.

Next year, the Library of Congress will close its catalog and "bring to an end a century-old system for the organization of knowledge." Gay knowledgeably describes the intricacies, quaintnesses, and social values that characterize the Library of Congress classification system. While admitting that the card catalog is a deteriorating "dinosaur," plagued by dog-eaten cards and inconsistencies, she is skeptical about the wisdom of libraries' eager abandonment of the catalog for the computer. There will be no more serendipitous discoveries for the card-shuffling scholar -- "only the right code word will release the treasure."

HUNTER, LOUIS C. A HISTORY OF INDUSTRIAL POWER IN THE UNITED STATES, 1780-1930. Vol. I. WATER POWER IN THE CENTURY OF THE STEAM ENGINE. Charlottesville: University Press of Virginia, 1979. xxiv, 606 p. Ill., tables, appendixes. Hard cover, $24.95.

Louis C. Hunter, long known for his excellent study, Steamboats on the Western Rivers (1949), has with the publication of this volume switched from the study of mobile power to that of stationary power as used for industrial applications in mills, mines, and factories. Waterpower in the Century of the Steam Engine is the first of a projected three volume study of the history of power which was such a central feature in the process of industrialization. The author's primary attention is directed to power generation but he is also concerned with distribution and application. Thus, with water power the essential supporting facilities --the millwork, dams, and raceways-- receive extensive consideration. From 18th century rural grist mill to the development of the hydraulic turbine, Hunter discusses design, construction and operation through excellent diagrams, illustrations and text. Numerous tables help to flesh out the economic framework within which his technological analysis rests. The effect of this volume should be to reestablish attention to the importance of water power for American industrialization during the 19th century. Publication of volumes 2 and 3 on steam power and the "transmission revolution" and the spread of electrical power respectively should round out the evolving story of industrial power. A well-done, comprehensive study in the history of technology and economics.

IVASHEVA, VALENTINA. ON THE THRESHOLD OF THE TWENTY-FIRST CENTURY: THE TECHNOLOGICAL REVOLUTION AND LITERATURE. MOSCOW: PROGRESS PUBLISHERS, 1978. 211 P.

A communist view of the influence of the scientific and technological revolutions on Western literature begins by attempting to explain the increased popularity of the documentary, science fiction, and the inclination to "philosophize" in literature. Ivasheva then turns to the literary use of the theme of time and space as conceptualized by Einstein. Discussion of the influence, physiology, and "psycho-physiology" on writers leads to a treatment of the growing place in Western literature, of themes centered on personality disorders. The final chapter discusses the alterations in the artistic portrayal of the human personality as a result of increasing knowledge of psychic processes.

KELLY, PATRICK, AND KRANZBERG, MELVIN, EDS. TECHNOLOGICAL INNOVATION: A CRITICAL REVIEW OF CURRENT KNOWLEDGE. SAN FRANCISCO: SAN FRANCISCO PRESS, 1978. XVIII, 390 P. BIBLIOG. $27.50.

This state-of-the-art study was compiled under a National Science Foundation grant to further understanding of R and D. Part 1 covers "The Ecology of Innovation," while Part 2 covers "Aspects of Technological Innovation." Among the contributors are Kranzberg, Frederick Rossini, Nathan Rosenberg, Paul Strassman, James Bright, Thomas Parke Hughes, and Simon Kuznets. There is a lengthy bibliography which, although not annotated, contains a wealth of material.

MEIKLE, JEFFREY L. TWENTIETH CENTURY LIMITED: INDUSTRIAL DESIGN IN AMERICA, 1925-1939. PHILADELPHIA: TEMPLE UNIVERSITY PRESS, 1979. X[illegible], 249 P. ILL. BIBLIOG. $17.50.

Meikle focuses on the emergence of the industrial design profession during the Depression era. Designers hoped to create a coherent environment for the "machine age" and reverse the economic downswing. Although no theory was recognized as supreme, streamlining was the most important component; it gave visual impetus to the desire for "frictionless" technological progress. "In the American tradition of practical eclecticism they [industrial designers] took whatever seemed modern and transformed it for commercial use . . . . In addition to serving an economic function, the style . . . both expressed and stimulated an optimistic, often utopian mood shared by ordinary people concerned with nothing more than purchasing the latest refrigerator." Although streamlining and the larger vision of a harmonious machine age failed to survive World War II intact, industrial design continues to influence business as a sales technique. 149 photographs contribute to the usefulness of this history.

PICKETT, WILLIAM BEATTY, ED. TECHNOLOGY AT THE TURNING POINT. SAN FRANCISCO: SAN FRANCISCO PRESS, 1977. IV, 75 P. $6.25.

Six papers presented at the Rose-Hulman Bicentennial Conference on American Technology -- Past, Present, and Future are included in this brief volume. Authors and titles are: Thomas P. Hughes, "Edison's Method;" Ruth Cowan, "Women and Technology in American Life;" Melvin Kranzberg, "Technology the Liberator;" Paul Horwitz, "Public Fiends and Private Technology;" Joseph Weizenbaum," Computers and Hope;" and Victor Ferkiss, "The Future of American Technology." The "turning point" generally reflected in all papers is the changing perception which no longer regards technology with unbounded optimism, but rather recognizes its threat to life and liberty at the same time it benefits humankind.

ROBERTSON, JAMES. THE SANE ALTERNATIVE; A CHOICE OF FUTURES. ST. PAUL, MINN.: RIVER BASIN PUBLISHING COMPANY, 1978. 152 P. $4.95.

The "sane alternative" Robertson advocates is a decentralized equilibrium economy based on the individual, unstructured economic activities of households and communities. The SHE future (sane, human, ecological) is compared with four less desirable futures: business as usual; disaster; totalitarian conservationist (TC); and hyper-expansionist (HE). The attainment of a SHE future requires not only the transformation of economic institutions, but also a shift from a societal paradigm based on academic knowledge, bureaucratic government, and professionalism to one based on intuition, community politics, and personal relationships. A directory of groups and individuals supplements the book, and there are study questions at the end of each chapter.

SHEPARD, JON M.; KIM, DOUG. I.; HOUGLAND, JAMES R., JR. "EFFECTS OF TECHNOLOGY ON INDUSTRIALIZED AND INDUSTRIALIZING SOCIETIES." SOCIOLOGY OF WORK AND OCCUPATIONS 6 (NOVEMBER 1979): 457-81.

American studies have suggested that in the course of technological development, worker alienation peaks during the mass production stage, but then declines with the advent of automated systems. Results of a comparative survey of American and Korean workers in the oil refining and auto industries provides new evidence for the idea that the stages of industrialization create similar structural and cultural changes wherever they occur. However, Korean workers appear, on the whole, to be less satisfied and more alienated than their American counterparts. The authors suggest that, perhaps as part of the industrializing process, nations develop appropriate adaptive mechanisms.

SJOBERG, LENNART. "STRENGTH OF BELIEF AND RISK." POLICY SCIENCES 11 (AUGUST 1979): 39-57.

Subjective probability, the subject of this paper, is defined here as "the strength of belief that a certain person holds in the occurrence of an event." A consideration of subjective probability is important to the study of risk for two reasons: experts incorporate subjective judgements in empirical risk assessments; and society responds to technology in accordance with subjective perceptions of risk. Sjoberg reviews the research on subjective probability, encompassing psychological versus statistical uncertainty, the interaction of beliefs and values, and problems of measurement.

°°°Christine Roysdon
Lehigh University Libraries

°°°Judith Mistichelli
Library of Congress

SHOT SYLLABUS EXCHANGE

Additions to the history of technology syllabus exchange (see Issues #11, pp. 11-13; #12, p. 16; and #13, p. 11) include the following courses and brief descriptions:

Prof. Lee Smalley
Industrial Teacher, Education Department
University of Wisconsin-Stout, Menomonie, WI 54751

Impacts of Technology

A two-credit graduate course taking a historical, contemporary, and futuristic look at some of the economic, sociological, psychological, and political implications of industry and technology.

Profs. Merritt Roe Smith
and David F. Noble
Program in Science, Technology and Society
Room 20B-222, M.I.T., Cambridge, Mass. 02139

History of Technology in America: 1776-1876

A one-semester course that examines specific engineering achievements from the Revolutionary Era to the Philadelphia Centennial Exhibition. Particular emphasis is placed on technology as an expression of American culture.

OPEN FORUM

Science, Technology, and Human Values Seminars

The National Endowment for the Humanities has announced that its program of Summer Seminars for College Teachers will offer 120 eight-week seminars during the summer of 1980. Twelve college teachers will be selected to attend each seminar, and participants will receive a stipend of $2,500 to cover travel expenses to and from the seminar location, books and other research expenses, and living expenses. The purpose of the program is to provide opportunities for faculty at undergraduate and two-year colleges to work with distinguished scholars in their fields at institutions with library collections suitable for advanced research. The 1980 Summer Seminars for College Teachers brochure, which lists seminar topics, directors, dates, and locations will be available locally from department chairpersons or from the Division of Fellowships, National Endowment for the Humanities, 806 15th Street, NW, Washington, D.C. 20506 after January 1, 1980. College teachers interested in applying to a seminar should write directly to the director (addresses are listed in the brochure) for detailed information and for application materials. The deadline for submitting applications to directors will be April 1, 1980. Four seminars are particularly related to Science, Technology, and Human Values:

Director/Location	Topic
Asger Aaboe Dept. of History of Science Box 2145 Yale Station New Haven, Connecticut 06520	*Exact Sciences in Antiquity and the Middle Ages*
Stephen G. Brush Dept. of History University of Maryland College Park, Maryland 20742	*The Second Scientific Revolution*
E. Fred Carlisle Dept. of English Michigan State University East Lansing, Michigan 48824	*The Functions of Discourse in Science and Literature*
Dudley Shapere Dept. of Philosophy University of Maryland College Park, Maryland 20742	*The Interpretation of Scientific Change*

The 1980 Business History Conference

will be held March 6, 7, 8 at Lehigh University. Numerous papers on the technological aspects of business growth and development are included under the following session headings:

- *The Iron and Steel Industry: Aspects of Industrial Organization in the Eighteenth and Nineteenth Centuries.*
- *Businessmen as Innovators: Ideology and Organization.*
- *The Rise of Big Business: Aspects of Reform and Reorganization.*
- *Investment and Building Strategies: Canals and Railroads.*
- *Labor, Technology, and Finance in the Early Years of Industrialization.*
- *The Iron and Steel Industry: Labor and Community Relations.*

For further information on specific paper titles and their authors or on times and registration for the conference write to: Bruce R. Dalgaard, Director, Center for Economic Education, Drown Hall #35, Lehigh University, Bethlehem, PA 18015 or call 215-861-3401.

INTERFACE 80

The Department of History and English of Southern Technical Institute in conjunction with the Humanities and Technology Association is sponsoring the fourth annual national conference on the humanities and technology in Marietta, Georgia, October 23-24, 1980.

Papers and presentations in the growing discipline of technology and culture studies which examines the integration of humanistic concerns and technological growth are invited. To focus fully on this interaction, submissions could deal with the following areas:

--History and philosophy of science, technology and architecture
--Public policy and understanding of science and technology
--Curriculum design for the humanities and technology
--Roles and effects of technology in science fiction, American culture studies, and popular culture
--Responses of literature, aesthetics, and the arts to technology

The deadline for submission is May 1, 1980.

Abstracts and/or papers should be addressed to: Dr. Roberta D. Gates or Dr. Amos St. Germain, Department of English and History, Southern Technical Institute, Marietta, Georgia 30060 (404-424-7203 or 424-7202).

A Workshop On Ethics And Public Policy

for teachers, scholars, and practitioners interested in the field of ethics and public policy will be held in Chestertown, Maryland on the campus of Washington College, June 22-28, 1980. The workshop will be sponsored by the University of Maryland's Center for Philosophy and Public Policy, in collaboration with the Institute of Society, Ethics and the Life Sciences.

Workshop participants will be exposed to readings, examples and discussion of two areas where normative concerns and public policy join: (1) moral problems confronted by public officials; and (2) analysis of policy tools available for decision-making.

The first half of the program will concentrate on two areas where professionals must exercise moral judgment in the course of their employment: truth-telling and reverse discrimination. The second portion will turn to decision-making tools and frameworks policy-makers often rely on when faced with decisions. These tools -- such as cost/benefit analysis and welfare economics -- are seldom ethically neutral. The workshop will examine these tools from normative perspectives.

The format will include speakers from government agencies with relevant program responsibility and faculty members with experience in ethics and public policy. Readings will be distributed in advance, and there will be extended small-group discussions. The sessions will be designed to be especially useful to persons of both academic and policy-making institutions.

For further information and application forms please contact: Peter G. Brown, Director, Center for Philosophy and Public Policy, University of Maryland, College Park, Maryland 20742 -- phone: (301) 454-4103.

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program

Director: Steven L. Goldman
Editor: Stephen H. Cutcliffe

Number 18
June 1980

Arrogance and Learning

In the human condition, no form of arrogance is more striking than that of ignorance determined to preserve itself. The history of humanity is in significant measure a record on the one hand of triumphs over resolute ignorance and on the other of defeats by ignorance totally self-satisfied. Because every generation of human beings begins in total illiteracy, ignorance is in constant supply; and because it is so arrogant --that is, because ignorance normally has its own strong convictions about what is worth learning and what is unimportant-- education is often an uphill struggle.

Ignorance finds innumerable sanctuaries to protect it from the encroachments of learning. In practice, the disciplines of the humanities, the sciences, the fine arts, and mathematics are the most alien to the convictions of ignorance, because they take the greatest patience and effort to learn. The most notable refuge of ignorance is the appeal to utility; here ignorance reigns supreme. By appealing to utility --by asking "What is this knowledge for, how is this learning to be used?"-- ignorance can always presume to pronounce on the question of what individuals need or are likely to need to know. In this fashion, ignorance can deny at will the need to know, not only these specific disciplines, but discipline itself. And in fact, it is precisely in this resistance to discipline as such that ignorance exercises its greatest and most abiding passion.

This complacency of ignorance has contributed to the temptation in education to forego studies in the humanities, the sciences, the fine arts, and mathematics. Education in many settings has yielded to these temptations --in order to attract students, balance budgets, and in general pander to fashion. Thus in 1967, R. S. Crane could write in *The Idea of the Humanities* that the humanities "have been undermined by the increasing neglect of the classical languages, by the ravages of the elective system, by the rapid infiltration of vocational and professional subjects...," while just twelve years later Frederick Rudolph could call attention in *Curriculum: A History of the American Undergraduate Course of Study Since 1636* to the fact that "scientific illiteracy became a characteristic of college educated Americans sometime toward the middle of the twentieth century, if not before."

The sciences, the fine arts, the humanities, and mathematics are together the victims of the appeal to utility, and together they must marshall their defenses. They constitute and represent much of the life of the mind; they are the repositories of much of the history of civilized intelligence; and the opportunity to gain access to them ought to be viewed as a birthright to everyone born in civilized society. It is an affront to reason that any vision of education should neglect opportunities for students to learn of the cultural heritage of humanity, of the great achievements of human intellect and feeling made through the practice of these disciplines. But ignorance is not by its nature amenable to reason, and no one can be persuaded by reason to be reasonable. For this, there must be a will to know, to understand, and this will must be sufficient to overpower the inertia and barrenness of ignorance content with itself.

Of the appeal to utility, the community of educators deserves to understand its limits and its frailties. The arrogance of the appeal is patent in its insistence that the value of any particular learning must be demonstrated to the satisfaction of ignorance, ignorance which refuses to pursue learning until the demonstration is complete. Prove, the appeal runs, that understanding the evolution of science and of scientific method, that knowledge of humane letters or of languages, that the capacity to listen with comprehension to a symphony or to look with informed sensibility on a painting or dance, that grasping a geometric proof --prove, that the achievement of these powers has some use. The appeal puts disciplined study on defense, and it frees ignorance from defending itself. Things ought to be the other way around --ignorance should be made to justify itself, because the folly of any such ostensible justification would be obvious on its face --but things are not likely ever to take that shape. Accordingly, the question becomes what the response of these disciplines to the appeal to utility ought to be.

First, the disciplines ought to acknowledge that the appeal to utility is not without force, and that people ought to have opportunities to study what is obviously useful in the marketplace. At the same time, they ought to insist that the practical is not reducible to the immediately useful, and they ought to stand on the ground that it is impractical and self-defeating to treat either oneself or one's education as a means merely to any end whatsoever. The disciplines of the sciences, mathematics, the fine arts, and the humanities have, as Moody Prior explains in *Science and the Humanities*, a potential formative influence which may or may not take in specific individuals, a potential formative influence on breadth of vision and depth of comprehension. They are means of ordering a life and of coming to grips with the world. They are among the basic *definiens* of taking life seriously.

To this line of argument, the appeal to utility inevitably replies that the relation of these disciplines to making one's way in "the real world" is not adequately clear. It is in this that the arrogance of ignorance is most pronounced, for here it offers a prescription for what should be viewed as "real" and thus for what should be taken truly to matter. On this subject, the disciplines ought never to retreat. They must, in fidelity to the conditions of their own possibility, explain without exception that classrooms are as real as the rest of the real world; that ideas, thoughts, reflections, and informed judgment are real and have potency in human existence; that a disciplined mind is a reality and that the alternatives to it are all too real in human history; and that the world --the meaning of events, the directions of the future-- is not transparent to ignorance. Coming to a reliable sense of what is real and what matters is an achievement. It takes effort and patience, and it is a career for a lifetime. In the pursuit of this career, learning generates humility and combats the arrogance of ignorance.

The sciences, the arts, mathematics, and the humanities are, at their best, faithful to the same ideals of personal discipline and intellectual integrity. They cannot afford the luxury of quarrels with each other, but must stand together in the interest of students and of their having opportunities to learn of the giants on whose shoulders humanity is able to stand. To neglect these matters in education is to lose sight of the fundamentals and to encourage the persistence of indifferent ignorance. It is to cheat the young of their rightful inheritance.

Edwin J. Delattre, Director
National Humanities Faculty
Concord, Mass. and President-elect,
St. John's College, Annapolis, Maryland
and Santa Fe, New Mexico

Science, Technology & Society, supported by a dissemination grant from the National Endowment for the Humanities, is a newsletter devoted to material in the general area of science, technology, and human values. We will publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we would welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, overcoming administrative reluctance, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the STS field. Please address all contributions and correspondence to: Dr. Stephen H. Cutcliffe, STS Program, 216 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015.

Course Syllabus
Materials in the Development of Man

Materials in the Development of Man takes a somewhat different approach than many other STS courses; it seeks to study the interactions between technology and society through a deeper examination of developments in one specific technology area. As such, the course requires some qualitative understanding of materials science and technology (acquired in class during the semester) in order to make sense of its societal implications.

The first part of the course introduces the student to some fundamental qualitative concepts of the structure and composition of materials. This is immediately followed by an example of how this newly acquired understanding of materials technology may be used to examine the economic decline of the Roman Empire and Republic through a study of its coinage. The development of copper, bronze, and iron working technologies in the Middle East and China are examined in detail, and the interactions between the developing technologies and the coordinate civilization are described. General examples of the development of empirical technology are given, as well as one particular in-depth case study concerning the metalworking processes for the manufacture of the Japanese sword.

The instructor finds it useful to focus on the interactions of technology and society in the Eastern cultures of China and Japan, and then to compare these with more recent Western cultural developments. The students appear to perceive critical relationships and values more clearly with this approach, possibly because of lack of any built-in biases.

The development of modern science and those aspects of the Industrial Revolution in both Europe and the U.S. which relate to materials technology are reviewed, and a historical perspective is given to the analysis of the social impact of science and technology (Ludd, Marx, Huxley, Bernal, Taylor, Schumpeter, Holloman, Kantrowitz, Schumacher, Snow, Bevan). The class visits the Lock Ridge Furnace Museum (a reconstructed anthracite iron blast furnace) to study the iron technology extant during the Industrial Revolution in the U.S. The development of X-ray research techniques and their importance to experimental studies and understanding of atomic and crystal structure is presented as a case study. The philosophy of modern engineering design is discussed through examples relating mostly to mechanical failure of engineering structures. In connection with this the film "No Highway" (Jimmy Stewart, Marlene Dietrick) is shown in class and discussed. Finally, the current approaches to research and development in the U.S. are compared and contrasted with Europe and Japan, and the particular problems of research for social needs such as energy technology and mass transportation systems are discussed.

The past semester, the major emphasis of the Semester Study Project was related to an examination of the book *Giving Up the Gun* (Noel Perrin, Godine Press, 1979). The book describes Japan's rejection of the use of Western firearms for warfare and its reversion to the sword during the period 1543-1879. The class examined this event in terms of the ability of a technologically sophisticated society to make decisions that influence its cultural values. Term papers on various aspects of the topic were handed in prior to the end of the term, copied, and the entire project report given to each student during the last class; each student then gave a five-minute verbal presentation on the highlights of the work done and the instructor summarized. This last class was held at a local pub where the environment was found to be eminently conducive to a free and easy discussion.

°°Michael R. Notis

STS-MET 221

Instructor: Dr. Michael R. Notis

Dept. of Metallurgy and
Materials Engineering
Lehigh University

COURSE OUTLINE

Lecture No.	Topic
1.	Introduction -- Technology and Society; Role of Materials Technology.
2.	Concepts of Atomic Structure; Arrangements of Atoms.
3.	Pure Elements and Alloys; Solid Solutions; Phase Diagrams; Cu-Ni System.
4.	Eutectic and Peritectic Alloys Cu-Ag, Cu-Zn, Cu-Sn Systems.
5.	Metallurgy of Ancient Coins; Optical Microscopy (Demonstration Lab).
6.	Technology and Civilization; The Development of Pyrotechnology.
7.	Copper Age; Bronze Age; Trade Routes in Middle East; Tin Mystery; Chinese Bronze.
8.	Crystallography; Imperfections; Solid Solutions; Defects in Solids.
9.	Diffusion; Bonding and Joining Methods; Recrystallization and Grain Growth; Modern Analytical Methods (Demonstration Lab); SEM and Electron Microprobe Analysis.
10.	Ferrous Metallurgy; Early Iron Age to Post-Medieval Metallurgy; The Fe-C Phase Diagram.
11.	History of Iron in China, Korea, India, and Japan.
12.	Empirical Technology and Science; History of Japan; The Japanese Sword - The Epitome of Empirical Technology; The Development of Japanese Metalcrafts: Interactions of Technology and Culture.
13.	Formulation of Semester Study Project -- Technology, Religious, Historical, Culture Aspects of Semester Study Project.
14.	Mechanical Properties of Materials; The Mighty (or Weak) Dislocation; Cold Work, Annealing, Recrystallization.
15.	Fracture and Crack Stopping: Of Ships, Bells and Molasses Tanks Engineering Design Philosophy.
16.	Ceramics -- Ancient and Modern; The Development of Glass; Polymers; Paint Pigments and the Development of Painting; Composite Materials -- Natural (wood) and Manmade.
17.	Technology, Science and Society -- East versus West; Bernal, Luddism, Needham.

18. Ferrous Metallurgy. Medieval Metallurgy.

19. Recent History of Iron and Steel Making: The Industrial Revolution.

20. Steelmaking in the U.S. 1776-1976+; Modern Industrial Steel Practice (visit to Lock-Ridge Museum).

21. The Science of Metallurgy: Modern Heat Treating of Materials: Hardening and Aging: X-ray Studies of Materials.

22. The American Research and Development System; Materials Problems in Modern Energy Technology: Nuclear.

23. Materials Problems in Modern Energy Technology; Energy Transport Superconductors - Mass Transit Systems.

24. Review of Semester Project at the Tally-Ho Tavern.

Texts

A. Required

Perspectives on Technology, Nathan Rosenberg (available in bookstore).

Notes on the History of Materials, class notes (available from instructor)

B. Optional - (please read at least one)

*, ** 1. Gordon, J. E., *The New Science of Strong Materials*, Walker & Co. (1968).
** 2. Gordon, J. E., *Structures*, Pelican (1978).
*, ** 3. Rosenberg, N., Vincenti, W. G., *The Brittannia Bridge - The Generation and Diffusion of Technological Knowledge*, MIT Press (1978).
** 4. Seligman, M. E. P., *Helplessness*, W. H. Freeman & Co. (1975).
*, ** 5. Pirsig, *Zen and the Art of Motorcycle Maintenance*, Morrow (1974).
** 6. Clavell, Jr., *Shogun*, Dell (1975).
** 7. Dolgun, A., *An American in Gulag*, Ballantine (1975).
** 8. Shute, N., *No Highway*, Morrow (1948).
*, ** 9. Doan, G. E., *Bradley Stoughton*, ASM (1937).
** 10. Perrin, N., *Giving Up the Gun*, Godine (1978).
(M) ** 11. Alexander, W. and Street, A., *Metals in the Service of Man*, Penguin (1976).
(M) ** 12. Hudson, M., *Structure and Metals*, Hutchinson (1973).
*, ** 13. Tylcote, R. F., *History of Metallurgy*, The Metals Society (1976).
*, ** 14. Smith, C. S., *History of Metallography*, University of Chicago Press (1960).

NOTES: (*) available in library.
(**) available from instructor.
(M) materials science background reading.

Course Syllabus
Perspectives in Technology and Environment

History 185
Prof. A. Hunter Dupree

Brown University
Providence, R.I.

General Information:

1. This course is a history course which will attempt to introduce concepts from several other disciplines as well. As such it is open to students from all departments of the university on the assumption that whatever background a student brings will be useful.

2. The reading will be an integral part of the course and should be done during the period indicated on the lists as a preparation for understanding the lectures and class discussions.

3. There will be a paper due the first day of the reading period which will be an exercise in applying systems concepts to a specific historical situation. A more detailed instruction sheet will appear later.

4. The mid-term examination and the final examination will comprehend the material in lectures and the required reading lists.

Reading List

General & Contemporary Background:

R. M. Pirsig, *Zen and the Art of Motorcycle Maintenance.*

Science magazine is a weekly which covers the news of contemporary technology and environment. Each student is expected to check it for editorials, letters, general articles, and news reports each week.

Required Reading by October 4:

Odum, H. T., *Environment, Power and Society.*
Simon, H. A., *The Sciences of the Artificial.*

Required Reading by November 1:

Pacey, A., *The Maze of Ingenuity*, Chs. 1-5.
Braudel, F., *Capitalism and Material Life.*
Crosby, A. W., *The Columbian Exchange.*

Required Reading by End of Semester:

Pacey, *The Maze of Ingenuity*, Chs. 6-9.
Morison, E. E., *Men, Machines and Modern Times.*
Mumford, L., *Technics and Civilization.*
Marsh, G. P., *Man and Nature.*
Webb, W. P., *The Great Plains.*
Either: Landes, D.S., *The Unbound Prometheus.*
Or: Giedion, S., *Mechanization Takes Command.*

Schedule of Lectures:

Interactions in the Age of the Expansion of Europe

1.	Sept. 20	Introduction: technology, culture, and environment.
2.	Sept. 22	Systems and history: systems thinking since World War II.
3.	Sept. 27	Information and energy. (Simon).
4.	Sept. 29	The units of measure in the interaction of technology and environment.
5.	Oct. 4	Ecology and technology. (Odum).
6.	Oct. 6	The Old World System. (Braudel).
7.	Oct. 11	Sixteenth century expansion of Europe. (Braudel).
8.	Oct. 13	Maritime technology and the Americas. (Braudel, Crosby).
9.	Oct. 18	The measure of the earth.
10.	Oct. 20	Technology and environment in pre-Columbian America. (Crosby)
11.	Oct. 25	Cultural and biological interaction between the hemispheres.
12.	Oct. 27	The foundations of the worldwide technological system.
13.	Nov. 1	Midterm.

Transformations of Technology and Environment, 1750-1850

14.	Nov. 3	The end of the pre-industrial era. (Mumford).
15.	Nov. 8	The Industrial Revolution I. (Morison, Mumford, Landes).
16.	Nov. 10	The Industrial Revolution II.
17.	Nov. 15	Machines, people, and factories.
18.	Nov. 17	Canals and railroads.
19.	Nov. 23	Progress or dark, satanic mills.
20.	Nov. 29	Agricultural systems in an industrial setting.
21.	Dec. 1	Agricultural systems II.
22.	Dec. 6	Risks and safety in nineteenth century technology.
23.	Dec. 8	Environmental costs of nineteenth century energy systems.
24.	Dec. 13	Control systems for a high energy technology.
25.	Dec. 15	The role of science in technology. FINAL EXAMINATION

Retrospective Technology Assessment: A Review Essay

If technology assessment is the study of technology's projected impact upon society, especially in areas where the results are unexpected or delayed, what is *retrospective* technology assessment and what is its purpose? Answers are still emerging and these questions are by no means resolved, but a brief review of some of the literature in the newly developing field of retrospective TA may be useful, especially for those who, even if not technology assessors themselves, might be contemplating the inclusion of a section on TA in a course on technology and human values.

In what has become a frequently quoted article, at least by historians of technology, Lynn White, then president of the American Historical Association, set the tone for the emergence of a new field by noting that, "technology assessment, if it is not to be dangerously misleading, must be based as much, if not more, on careful discussion of the imponderables in a total situation as upon the measurable elements. Systems analysis must become cultural analysis and in this historians may be helpful." It was White's contention that "history can offer no solutions, but it may help to guide an acute mind toward kinds of questions that in the present state of systems analysis tend to be overlooked. Above all it may illuminate the limitations as well as the possibilities of assessing technology."[1]

Since then others have picked up the call. Carroll Pursell in his March 1974 Andrew W. Mellon lectures at Lehigh University offered a critique of current technology assessment practices and in addition to other suggestions echoed White's contention that historians have a useful role to play in the assessment process.[2] In the same year, Joseph Coates, then with the National Science Foundation, actually coined the phrase "retrospective technology assessment." In a request for proposals, Coates suggested the usefulness of historically-informed insight for testing and analyzing methods used in anticipatory technology assessments.[3] This was not because the historian can teach us absolute truths learned from the past, but because of the potential insights that might be gleaned from historical analysis, for example, an awareness of the kinds of social questions that contemporary technology assessors might otherwise fail to raise. Thus was born a new subdiscipline, that of historical case studies of the development and societal impact of new technologies, in the hope that it would refine our insights into the relationships between technology and society and improve future technology assessments.

What of the offspring? To date only a handful of retrospective TA's have emerged. Generally they have been of good historical quality but reflect the growing pains of any new field. This has been especially true when the authors move from historical reconstruction to generalizations useful to contemporary technology assessors. The problem of making history "relevant" to today's society has been with us a long time and need not be discussed here at great length. However, one example from recent historiography may help suggest a framework for reviewing the current literature in retrospective TA.

In 1965 Prof. Bruce Mazlish published the results of a research project using historical analogy as a "device of anticipation" for better understanding the impact of the, then relatively new, space program on society. Mazlish and his co-authors chose the coming of the railroad as the "social invention" most analogous to the space program. In what may well have been the first retrospective TA, so to speak, *The Railroad and the Space Program* encapsulated the team's attempt at "a systematic, integrated study of a comparable total impact."[4] Mazlish outlined several goals for the project, the two most important of which involved the actual history of the impact of the railroad on American society and the value of this analysis as a "device of anticipation." With respect to the historical reconstruction the team which included such noted historians as Thomas Parke Hughes, Robert W. Fogel, Paul Cootner, Alfred D. Chandler, Stephen Salsbury, Thomas Cochran, Robert Brandford, and Leo Marx succeeded admirably well. They provided a good analysis of the technological, economic, political, sociological, and intellectual impacts including those often unexpected, delayed and secondary results. Concerning the second major goal, that of providing an analogy with the space program, the project did not fare as well. Recognizing that the difficulties of each of the historians acquiring more than just a superficial knowledge of the space program would at best be difficult, Mazlish took upon himself the task of drawing out appropriate comparisons and reaching some general conclusions. His generalizations included the following:

1. All social inventions are part and parcel of a complex - and have complex results. Thus, they must be studied in multivariate fashion.
2. No social invention can have an overwhelming and uniquely determining economic impact, and this is so partly because no completely new innovation is possible in reference to any set of economic objectives.
3. All social inventions will aid some areas and developments, but will blight others.
4. All social inventions develop in stages, and have different effects during different parts of their development.
5. All social inventions take place in terms of a national "style", which strongly affects both their emergence and their impact.[5]

Mazlish went on to warn against being misled by the "rhetoric of supposed primary purposes" because they often become subsumed by unexpected secondary consequences. Although there were several other lesser points made regarding the analogy, when all is said and done, the reader comes away from the volume with the feeling that he or she has learned a lot about the social impact of the railroad, but has learned little that could be applied to the space program.

That the volume succeeds as well as it does as an analytical device attests to Mazlish's insight, for any such groundbreaking endeavor will be difficult. At the same time, however, it points to a problem which faces more recent retrospective TA's. *If* they are to be useful for their intended purpose of helping contemporary technology assessors to ask better questions, they must be more than just good social histories of technology, for we have had that for some time with little discernable impact. They must draw out generalizations and hypotheses which can be further refined through successive case studies and *applied* to the ongoing process of technology assessment. With this in mind, I should like to comment briefly on a number of studies which have emerged in the last half-decade.

Following Joseph Coates' call for proposals, the NSF funded four retrospective technology assessments in 1975. The results of these projects are now generally available in one form or another. The projects included studies of the telephone (MIT); management practices (Forecasting International, a private research institute); wastewater management (Carnegie Mellon University); and submarine telegraphy (George Washington University). Initial findings in these studies were presented at a conference hosted by Carnegie-Mellon and sponsored by the NSF in 1976. In addition to presentations on these topics, there were a number of other papers on TA methodology, case studies, and technology and human values. The results have been edited by Joel Tarr and published as *Retrospective Technology Assessment - 1976.*[6] As might be expected from an initial conference in an emerging field, the results were mixed. Of the four methodological papers only one, that of sociologist Mary Hamilton, dealt with the use of history directly. In that case, the primary concern was with developing a statistically based standard case of the introduction and development of a particular technology, which could then be used to better understand future applications, continued expansions, or new locations of the technology in question. It would seem that this was not quite what Lynn White had in mind when he suggested the value of historians to the cultural analysis of imponderables. Happily the section on case studies remedies this concern to some degree.

The eight papers range chronologically from a study of the impact of the Erie Canal in Onondaga County, New York from 1820 to 1840 (Roberta B. Miller) to an analysis of modern communications satellites (Delbert D. Smith). In between are papers on the origins and impact of San Francisco's BART system (Henry Bain); the ways in which diplomacy was affected by the Atlantic Cable (Henry H. Hitchcock and Thomas F. Jaras); the U.S. Industrial Commission, 1898-1902 (Anne K. Nelson); the development of wastewater technology (Joel A. Tarr and Francis Clay McMichael); the electric "Superpower" movement, 1915-1924 (Terry Kay Rockefeller); and the evolution of the airport (Jerome E. Milch).[6]

The value of these papers varies widely, not because of the quality of the research (they all seem more than adequate in this regard), but because of the useful conclusions they reach applicable to anticipatory TA's. They ranged from Miller's which does not really generalize outward from past historical events which have no *direct* parallel in today's society to those of Tarr and McMichael and Smith which offer fairly concrete suggestions regarding water supply and communications satellites that could be incorporated into future anticipatory TA's. It is clear from these papers that while history can offer valuable suggestions for contemporary assessors, the suggestions will come from those analyses which treat specific examples of broad social-historical trends involving technology. To be truly useful, historical findings must be compared directly to contemporary concerns or placed in a generalizable framework that recognizes and outlines the value-laden nature of the technological decision-making process and the complementary interaction of technological results and their second-order effects.

Several of the NSF funded projects that were initially reported on at the 1976 conference have subsequently received more extensive analysis and the results are generally available in one form or another. Joel Tarr has published a series of articles on wastewater technology, several of them in conjunction with Francis McMichael.[7] In general Tarr and McMichael stress the importance of understanding that the adoption of a past technology frequently influences subsequent choices and developments. They further stress the importance of recognizing the inter-related social, political, and economic values underlying technological choice as well as subsequent impacts upon health, environment, government policy, even technology itself. Their conclusions could be of particular use to contemporary assessors who need to recognize that many of today's water/waste questions are the heritage of much earlier decisions. A single volume summarizing this research is planned for a series edited by Tarr entitled, "Cities and Technology," University of Indiana Press.

Two of the NSF funded projects are available only in manuscript form in a limited way, that of Forecasting International (FI) on management practices and of the MIT group on the telephone. Authored by Anne Nelson and George Foster, FI's report, *A Retrospective Technology Assessment of Management Technology: The Case of the United States Industrial Commission, 1898-1902*,[8] analyzed the USIC which was created by Congress in 1898 to examine the rapid technical and industrial changes which had affected the economy, the work process, and consumers. The Commission's importance lay in the fact that it concluded that large industrial firms were economically beneficial and could be compatible with a democratic society. Their recommendations had some long-lasting industrial policy implications. Based upon its analysis of the formation, functioning, and findings of the USIC, FI's report offers a number of additional implications for current technology assessments:

1. Holistic approaches contribute to the assessment and facilitate public acceptance of the recommendation.

2. TA is not an isolated event but an element in the larger policy-making process.

3. Technical analysis and policy derivation are separate functions.

4. While the technical analysis and policy formulation are separate functions, coordination of these functions contributes to the overall success of the TA process.

5. Conflict resolution is an important function of such assessments. To this end it is vital that citizen input be accommodated.

6. Policy formulators must not be so polarized in viewpoint that they are unable to work toward a consensus.

7. Legitimation of an assessment's results may best be accomplished during the process itself.

8. Implementation of formulated policy cannot be assumed.

9. It appears to be difficult to institutionalize TA's that take holistic approaches.

The MIT study on the impact of the telephone coordinated by Ithiel de Sola Pool emphasizes the importance of economic analysis for successful technology assessment.[9] The bulk of the report recounts those social impacts of the telephone which received some discussion during the period 1876 to 1940 including such effects as the reduction of farm isolation, the rise of the skyscraper, the facilitation of decentralized management, changes in political campaigning, and revised social etiquette. Of the 181 impacts noted, approximately three-quarters could be anticipated based on an economic analysis of available technical alternatives and consumer demand. While this is certainly a useful point of which to remind prospective technology assessors, it does not seem overly surprising. Unfortunately the analysis does not go beyond this concern. While it is often unfair to criticize an author for not doing something he never intended to do, it does seem unfortunate that a more complex analysis of the general nature of those economic concerns and more particularly the non-economic secondary social impacts was not attempted. It was precisely for the latter that Lynn White hoped history might be helpful.

Perhaps the most conceptually sophisticated study is that coordinated by Vary Coates and Bernard Finn on the Atlantic cable.[10] The study does several things. First, it provides a crisp historical summary of laying the cable, followed by an analysis of the technical, entrepreneurial, and political challenges and responses necessary for the success of the venture. The second major aspect of the study is an examination of the significant and long-lasting effects of submarine telegraphy --effects such as futures trading of commodities and stocks in an organized world market, improved and standardized techniques for weather forecasting, the rise of international news organizations, revised military strategies, and an increased centralization and bureaucratization of diplomacy. A third component is an analysis of Victorian observations and expectations regarding cable technology, including hypothetical, role-playing assessments based on gaming workshops and a Delphi questionnaire, to determine whether or not they might have more accurately forecast the results.

The final and most important section of the volume, at least for contemporary society, is that containing suggestions for prospective technology assessments. These summary conclusions bear quoting at length:

> 1. In many technological developments the most socially significant and long-lasting impacts will derive not from the physical characteristics of the technology but from the capabilities, services, and products it delivers. This feature should be considered both in choosing subjects for assessment and in allocating efforts within an assessment project.
>
> 2. In assigning priorities for allocating limited resources for anticipatory technology assessments, highest priority should be given to technologies that
>
> (a) will provide new societal capabilities rather than incremental increases in existing capabilities or in the economy and efficiency of technologies providing those capabilities;
>
> (b) are systems technologies, and therefore create new interdependencies between markets, institutions, social functions, communities, regions, or nations; and
>
> (c) promise large public benefits while potential private sector benefits are balanced or outweighted by threats to existing, heavily capitalized technologies and industries.
>
> 3. It is important to assess the capacity of social institutions relevant to a technological development to adjust and accommodate to the new technology and new societal capability --including adjustments

aimed at utilization of, support of, or defense against, the technology and resulting social change.

4. These institutional adjustments appear to follow a pattern: first, simple substitution of one technology for another with little change in activities and functions; second, adaptations in organizational behavior and operations to use the new technology more efficiently; and third, generation of new functions and activities made possible by the new technology.

5. Institutions differ in the speed and effectiveness with which they make such adjustments. In the case of submarine telegraphy our study suggests that the most rapid utilization of the technology, and the swiftest adjustments to it, were in institutions where

(a) organizational objectives were profit and/or growth;

(b) the organizational mode of operation was transactional and aimed at mutual benefit (exchange of cash, goods, ideas); and

(c) the organizational resources traditionally utilized to achieve objectives were economy, efficiency, and risk taking.

The slowest to achieve utilization and adjustment were institutions where

(a) organizational objectives were protection and preservation of existing advantages;

(b) the mode of operation was strategic, aimed at maximizing the benefits to one side; and

(c) organizational resources traditionally mobilized to achieve objectives were experience, judgments, and minimization of risk. In the first category were merchants, financiers, and newsgatherers; in the second, diplomats and national armed forces.

This study, which is available in paperback, could fruitfully be used in a history of technology course as well as courses on technology assessment or technology and human values.

In addition to these major NSF-funded studies there have emerged two articles in the past several years which while on widely different topics might be of some use to those teaching in this area. The first by Arlene Inouye and Charles Süsskind analyzes the Roosevelt administrations' 1937 report, *Technological Trends and National Policy.*[11] The Report which was primarily the work of the noted sociologist William F. Ogburn was an attempt to analyze the relationship of technology to social and economic change and predict, at least for the short run (ten to twenty-five years), the effects of key innovations. Inouye and Süsskind find that the Report was correct in its predictions only about fifty percent of the time and far less effective at forecasting secondary and tertiary social effects. Because it relied primarily on the opinion of conservative technical experts and only a few social scientists, the Report made few bold predictions, rather it consisted largely of extrapolations of existing trends. Even though by today's standards the Report had an unsophisticated methodology, it is historically useful as a means "to validate current and proposed methods in technology assessment by a sort of regression analysis - a critical examination of methods known to have been successful in the past." The authors also suggest based on their analysis that not only must assessors understand the policy process, but that the existing political framework must provide "a way in which recommendations and policies based on the assessment can be implemented and enforced." In all this, a historical understanding of TA and its development as "an art and a science" is important.

In contrast to the broad-ranging nature of the 1937 Report is John Perkins' focus on contemporary attempts at boll weevil eradication.[12] The boll weevil is a serious pest in the cotton industry causing an approximate 8% annual loss of crop yield. It is estimated that 30% of the pesticides used in American agriculture are directed toward the boll weevil with a resultant high environmental contamination.

Resistance to traditional pesticides and outbreaks of secondary pests have also occurred, with the result that new controls for the boll weevil are now being sought. The two major approaches presently under pilot study projects are cost-effective pest management without introducing secondary pests (containment) and eradication. These two mutually-exclusive strategies raise interesting questions regarding effectiveness, future research, and possible socio-economic dislocations. Perkins offers a historical analysis of the biological and political limitations that resulted in an earlier inconclusive, trial eradication project in the hope that evaluations of present trial projects will not suffer a similar fate. Here we have an example of a very direct and immediate use for historical analysis.

Having looked briefly at a number of retrospective technology assessments, what can be said of this emerging field? Clearly the studies range widely in time from the early years of the Erie Canal to contemporary entomological research and in scope from specific transportation and communication systems to national industrial assessment panels. Their approach ranges from traditional narrative to experimental techniques in gaming and Delphi. If history is to be of some use to contemporary assessors, it seems that the time is ripe for some broader analytical framework to be tentatively attempted. To my knowledge, no one has yet undertaken this task for retrospective TA's. In doing so, I would hope that sight will not be lost of the human and value-laden nature of technological decision-making and of the importance of the single event and human being. If there is one primary lesson to be learned from these RTAs and other social histories of technology it would seem to be that. However, if RTA's are to move beyond the realm of "merely" good social history of technology (as if that were not enough) and its function of understanding the development over time of culture and tradition (in a technological context), then something more is necessary. While a number of good tentative suggestions have been offered, as noted above, they are still diffuse, frequently offering contrasting emphases.[13] I find most of these studies useful in a case study context and see them as good possibilities for use in a number of STS-type courses.

I would be pleased to hear from anyone who knows of or is working on other retrospective technology assessment projects.
SHC, editor

FOOTNOTES

1. Lynn White, Jr. "Technology Assessment from the Stance of a Medieval Historian," *American Historical Review* 79 (February 1974): 3, 13.

2. Carroll Pursell. "Belling the Cat: A Critique of Technology Assessment," "A Savage Struck by Lightning: The Idea of a Research Moratorium," and "'Who to Ask Besides the Barber' -- Suggestions for Alternative Assessments." *Lex et Scientia* 10 (October-December 1974): 121-178, see especially 171.

3. Joseph Coates, National Science Foundation, *Awards for Technology Assessments in Selected Areas*, program solicitation 74-34, Washington, D.C. 1974. pp. 5-6 as quoted in Joel Tarr, ed. *Retrospective Technology Assessment - 1976* (San Francisco: San Francisco Press, 1977), p. iii.

4. Bruce Mazlish. *The Railroad and the Space Program: An Exploration in Historical Analogy* (Cambridge, Mass.: MIT Press, 1965), p. ix.

5. *Ibid*, 34-35.

6. Joel A. Tarr, ed., *Retrospective Technology Assessment - 1976*. A useful summary of the conference including the major findings of each study are included in a conference summary by Joel Tarr in *Technology and Culture* 18 (October 1977): 655-58.

7. Joel A. Tarr and Francis C. McMichael. "Decisions About Wastewater Technology: 1850-1932," *Journal of the Water Resources Planning and Management Division* ASCE. 103 (May 1977): 47-61; Tarr and McMichael, "Water and Wastes: A History," *Water Spectrum* (Fall 1978): 18-25; Tarr, "The Separate vs. Combined Sewer Problem: A Case Study in Urban Technology Design Choice," *Journal of Urban History* 5 (May 1979): 308-339; and Tarr, Terry Yosie, and James McCurley, "Disputes Over Water Quality Policy: Professional Cultures in Conflict, 1900-1917," *American Journal of Public Health* 70 (April 1980): 427-35. Tarr's final NSF report is published under the following title and is available from the National Technical Information Service. Tarr, et. al., *Retrospective Assessment of Wastewater Technology in the U.S., 1800-1972*. 2 vols. (Pittsburgh: Carnegie-Mellon University, 1977). Main Report: PB 275 272/3 SL $13.00; Appendix: PB 275 884/5SL $7.25.

8. Anne K. Nelson and George Foster, *A Retrospective Technology Assessment of Management Technology: The Case of the United States Industrial Commission, 1898-1902* (Arlington, Va.: Forecasting International, 1977). The unfortunate price of $100 per copy for the manuscript will make this material unavailable to many scholars except perhaps through interlibrary loan. Presumably technology assessment projects or panels would be able to afford a copy of the study.

9. Ithiel de Sola Pool, *Retrospective Technology Assessment of the Telephone: A Report to the National Science Foundation*. Vol. 1 (Cambridge, Mass.: Research Program on Communications Policy, Center for International Studies, MIT, 1976). A separate study also edited by Pool entitled *The Social Impact of the Telephone* (Cambridge, Mass.: MIT Press, 1977) contains a series of papers prepared for an earlier centennial seminar on the telephone held at MIT and includes a progress report on the retrospective telephone assessment project.

10. Vary T. Coates and Bernard Finn. *A Retrospective Technology Assessment: Submarine Telegraphy: The Transatlantic Cable of 1866* (San Francisco: San Francisco Press, 1979).

11. Arlene Inouye and Charles Süsskind. "'Technological Trends and National Policy,' 1937: The First Modern Technology Assessment." *Technology and Culture* 18 (October 1977): 593-621.

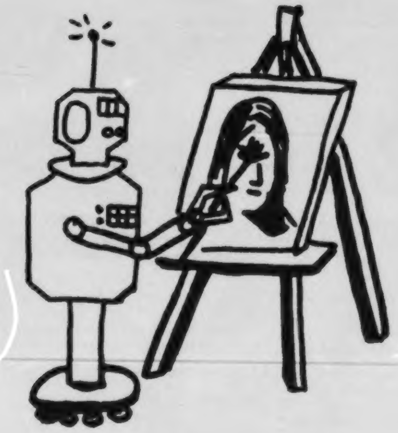
12. John H. Perkins. "Boll Weevil Eradication." *Science* 207 (7 March 1980): 1044-50. This article is a revised version of a paper delivered at a special session on RTA chaired by Joel Tarr at the 1978 meeting of the Society for the History of Technology (SHOT). A second, as yet unpublished paper, "The Politics of Urban Technology: Urban Growth and the Water Crisis in late-19th-Century Philadelphia," was read by Michael McMahon, in which he argued that the lack of a "coherent community" accounted for a failure to implement clearly outlined engineering alternatives to Philadelphia's water needs.

13. Joel Tarr has offered several parameters which might be used to delineate the field in his summary of the SHOT session noted above.

> (1) RTA should take as its starting point a contemporary policy problem involving technology and society; (2) investigators should utilize an analytical rather than a descriptive approach that focuses upon concepts and processes rather than events; (3) investigators should utilize interdisciplinary methods and, if possible, a team approach; and (4) the study should examine both quantitative and qualitative variables.

Technology and Culture 20 (July 1979): 597.

I would like to thank Joel Tarr for his assistance in the preparation of this article. Stephen H. Cutcliffe, Editor



M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

ANDERSON, ROBERT M.; PERRUCCI, ROBERT; SCHENDEL, DAN E.; TRACHTMAN, LEON E. DIVIDED LOYALTIES: WHISTLE-BLOWING AT BART. PURDUE UNIVERSITY SERIES IN SCIENCE, TECHNOLOGY AND HUMAN VALUES. WEST LAFAYETTE, INDIANA: PURDUE UNIVERSITY, 1980. 397 P. $4.95.

On March 2 and 3, 1972, three engineers working on the construction of San Francisco's Bay Area Rapid Transit System were fired. Concerned about the safety of the automatic train control system, they had expressed their fears to management, but had received little response. Frustrated, they had turned to BART'S Board of Directors and an outside consultant; subsequent newspaper reports triggered the dismissals. Utilizing interviews with the protagonists, correspondence, memos, reports, and published stories, the book offers thorough, if unexciting documentation and analysis of the highly publicized incident. Oddly, it appears that the relatively open, creative, independent climate at BART contributed to the crisis. Responsibilities were too loosely assigned; engineers could discover, but not solve problems. The authors also point to the "political naivete" of the engineers, who did not comprehend management's need to project and protect the trouble-free, glamorous, space-age image of BART.

AYRES, ROBERT U. UNCERTAIN FUTURES; CHALLENGES FOR DECISION MAKERS. NEW YORK: JOHN WILEY AND SONS, 1979. VIII, 429 P. $19.95.

"Time after time," Ayres writes, "....it turns out to be social, political, ideological, legal and economic issues that stand in the way of technological solutions to human problems." Contrasting alpha forecasts, which depict the future as an exaggerated version of the present, with omega forecasts, which project something radically different, Ayres hopes to steer a middle course. Achieving a satisfactory future requires that a balance be struck between four competing social goals - equity, economic efficiency, personal freedom, and stability or order. Ayres fears an American decline in economic efficiency. To renew that efficiency requires fresh optimism, a concern for the future, motivation, and a more positive attitude toward work. Helpful and harmful potential technologies for the next fifty years are sketched, including developments in agriculture, new products and materials, communications, undersea technology, and transportation. The book concludes somewhat pessimistically with scenarios depicting energy, food, and political crises in the 1980s.

BAUM, ROBERT J. ETHICS AND ENGINEERING CURRICULA. THE TEACHING OF ETHICS VII. HASTINGS-ON-HUDSON, NEW YORK: HASTINGS CENTER, 1980. 79 P. BIBLIOG. $4.00.

Beginning in 1977, the Hastings Center undertook a systematic study of the teaching of ethics in American higher education. This is the seventh of nine monographs that resulted from that project. Engineering ethics has generally been concerned with legality and professional protocol; engineering codes of ethics have never been analyzed in a critical way. Baum suggests a different scope for engineering ethics, with four goals for instruction: "stimulating the moral imagination;" "recognizing ethical issues;" "eliciting a sense of moral and personal responsibility;" and "tolerating-and resisting-disagreement and ambiguity." Baum argues that "ethicists" from such professions as industrial psychology, law, history of engineering, or the sociology of the professions - not engineers - ought to teach engineering ethics. A suggestion for topics for class discussion, an assessment of available literature, and a list of research needs and priorities are also included.

BELASCO, WARREN JAMES. AMERICANS ON THE ROAD: FROM AUTOCAMP TO MOTEL, 1910-1945. CAMBRIDGE: MIT PRESS, 1980. ILL. $14.95.

Rather than looking at what automobiles have done to people, Belasco explores the way Americans enjoyed their cars during the first three and a half decades of widespread automobile ownership. Stiffled by Victorian hotels and crowded boardwalks, bored by resort verandas, and scandalized by extravagant hotel fare, Americans found motor-touring (or autocamping or "gypsying") an irresistible alternative. The railroad, not the car, symbolized the scheduled rigidity, speed, and mechanized impersonality of the modern era. In contrast, the automobile projected individuality, freedom from formality and timetables, and the opportunity to explore remote and secret places. Aided by well-chosen photographs from the Library of Congress and the National Archives, Belasco skillfully explores the evolution of the family autocamp through subsequent stages - municipal autocamps, more exclusive "pay camps," family cabins and early motels. As auto-camping's popularity increased, so did its entrapments - elaborate plumbing, campfire cooking equipment, magazines, and the like. Belasco's is a rich and rewarding study on what at first might seem a humdrum topic.

BUSH, DONALD J. "FUTURAMA: WORLD'S FAIR AS UTOPIA." ALTERNATIVE FUTURES 2 (FALL 1979): 3-20.

At the 1939-40 New York World's Fair, the most popular exhibit was the diorama Futurama, housed in the "Highways and Horizons" building. The vision of Norman Bel Geddes (sponsored by GM), the diorama presented a City of the Future featuring well-spaced skyscrapers, pedestrian skyways and an interstate highway system complete with cloverleaves. Numerous tear-drop autos circled these roads, reflecting Bel Geddes celebration of the car, which "enables us to go out into the world ourselves." Bush reveals that in designing Futurama, Bel Geddes made use of sophisticated futurist techniques including trend extrapolation, scenarios, and models. But while he laments the dearth of well-informed visionaries today, Bush questions the desirability of a master-planned utopia: "Futurama was risk free not only in terms of auto safety but in eliminating any possibility of aesthetic error by its inhabitants." A more flexible scheme that allows inhabitants to fashion "an ever-fresh vision" is preferred.

FRYE, RICHARD. "THE ECONOMICS OF ECOTOPIA." ALTERNATIVE FUTURES 3 (WINTER 1980): 71-81.

The economy of Ernst Callenbach's Californian utopia is examined. Four economic principles implicit in the novel are explored: that a steady state economy can be fair and efficient; that an environmental ethic can be infused into an economic system without loss; that non-material human needs must figure into our accounting; and that a collectivist society can exist within a free enterprise system. Callenbach's enviable Ecotopians are described as "merry materialists" who enjoy a few, fine possessions, leisure, and a clean environment. Frye's only reservation is that Callenbach places too much weight on activities in the public sector, an emphasis which seems incongruous with the individualism and suspicion of government voiced by his characters.

JOURNAL OF THE NEW ALCHEMISTS-6. WOODS HOLE, MASS.: THE NEW ALCHEMY INSTITUTE, 1980. PUBLISHED BY THE STEPHEN GREENE PRESS, BRATTLEBORO, VERMONT. 184 P. ILL. $9.95.

The sixth annual of the Cape Cod "New Age Tool and Die Company" includes an absorbing history of the group as well as an overview of current projects at the Cape and at the "ark" in Costa Rica. Technical articles focus on windmills, tree crops, and agriculture. Concluding philosophical essays range from ruminations on art and the ecology of mind to a personal account of the Chilean civil war.

MELOSI, MARTIN V., ED. POLLUTION AND REFORM IN AMERICAN CITIES, 1870-1930. AUSTIN, TEXAS: UNIVERSITY OF TEXAS PRESS, 1980. XII, 212 P. BIBLIOG. $19.95.

The late nineteenth and early twentieth century American city witnessed an inflow of immigrants and an outflow of polluting effluents. Only after the pollution "nuisance" threatened to halt urban growth, as bad water and bad air sickened residents and discouraged potential investors, did many cities begin to seek solutions. Stuart Galishoff shows how the quality of the water system helped determine the growth or decline of Atlanta, Newark, and Chicago. R. Dale Grinder writes about the energetic but ultimately futile and naive anti-smoke efforts of reformers in the Progressive Era, when smoke still symbolized progress. Anti-noise efforts between 1893 and 1932 are traced by Raymond W. Smilor, who notes that the work of Julia Barnett Rice, in particular, culminated in the creation of quiet zones around hospitals and schools. The leadership of municipal engineers and women in urban environmental form is stressed in concluding papers. A useful bibliography is appended.

PILE, JOHN F. DESIGN: PURPOSE, FORM, AND MEANING. AMHERST: UNIVERSITY OF MASSACHUSETTS, 1979. 203 P. ILL., MAPS, BIBLIOG. $20.00.

Accepting the assumption that we will continue to live in a technologically complex environment, Pile calls for a recognition of the poor design of most of our modern artifacts and more control of the decision processes that result in how things are made. The intermediate steps between invention and delivery of manufactured products are the focus. A critical study of the range of design activity, meaning the process of choice in the creation of objects, towns, buildings, vehicles, etc., is presented. Those directions deemed generally harmful to the purposes of human life are identified. One problem is that the design or planning professions are divided in their attitude toward the arts--engineers steer away while architects identify with aesthetic pursuits. A teacher of design, Pile provides a concrete, step-by-step method for analysis in which he advocates identification of all elements of the function of an object and its means of production. Careful understanding of the effects of design decisions on resources, wastes, and health are demanded. Computers are seen as a helpmate.

TICHI, CECILIA. NEW WORLD, NEW EARTH; ENVIRONMENTAL REFORM IN AMERICAN LITERATURE FROM THE PURITANS THROUGH WHITMAN. NEW HAVEN AND LONDON: YALE UNIVERSITY PRESS, 1979. 290 P. $18.50.

American literature from the Puritans to the Romantics voices the concept of "modification" of the environment as an "ideological imperative that must proceed together with America's moral regeneration." Beginning with the Puritans, who considered the New England experience to be a carving of a New Jerusalem out of the wilderness, the virgin land was seen as chaotic and satanic. Its "reform" called for "aggressive topological change, much of it thought to be 'corrective' or 'reparative.'" This ideal appeared not only in literary form but also in such social programs as F.L. Olmsted's parks. Writers like Edward Johnson and Joel Barlow are considered "literary engineers" who decree that the American Eden is to be man-made. While Tichi may attach too much importance to technological considerations as the "impetus" of some of the literary works discussed, she succeeds in explicating the birth and nurturing of the American ideology of environmental manipulation as a product of this early literature. She also provides new understanding of the roots of the "American Dream."

TUCKER, BARBARA M. "THE FAMILY AND INDUSTRIAL DISCIPLINE IN ANTE-BELLUM NEW ENGLAND." LABOR HISTORY 21 (WINTER 1979-80): 55-76.

The study of the social environment of two early industrial communities, Slatersville, Rhode Island, and Webster, Massachusetts, reveals that the nuclear family as a laboring unit contributed heavily to the achievement of strife-free factories between 1790 and 1840s. The towns were organized to promote family solidarity, featuring small, but single-family homes. Factory discipline and obedience were readily integrated into a Calvinist tradition of childrearing. Males ruled in the factory hierarchy as well as at home; in some mills, entire families worked together. The family system eventually died out for a number of reasons. Among those cited by Tucker are the elimination of parental supervision of working children, outcries against child labor, and the payment of individual, rather than family wages.

WARRICK, PATRICIA S. THE CYBERNETIC IMAGINATION IN SCIENCE FICTION. CAMBRIDGE: MIT PRESS, 1980. 288 P. BIBLIOGS. $15.00.

A comprehensive history and a critical analysis of the subgenre of science fiction concerned with computers and robots are presented. Warrick is concerned with recurring images and patterns but she also explores the "cross-fertilizations" between writers and developments in theoretical science and technological innovation. Based on 225 stories and novels written between 1930 and 1977, the study provides an aesthetic of science fiction and reveals the discrepancy between the dystopian outlook of the fiction and the positive assurance prevailing in the field of computer science. The distinctions between the imaginative responses working from a "closed-system model" and the bright visions of man-machine symbiosis resulting from an "open-system model" are delineated. The author concludes that much of the literature is "ill informed about information theory and computer technology and lags behind present developments instead of anticipating the future." Discussions of such topics as the role of consciousness, complementary perception, the choice between a natural or artificial world, transformations, totalitarianism, computer and community, Asimov, Lem, and Dick are followed by extensive bibliographies of fiction and non-fiction. Among the most valuable critical studies of science fiction.

WEISBERG, GABRIEL P. "FRANCOIS BONHOMMÉ AND EARLY REALIST IMAGES OF INDUSTRIALIZATION, 1830-1870." ARTS MAGAZINE, APRIL 1980, PP. 132-5. ILL.

The son of a painter of scenes for carriages of aristocrats, Bonhommé found new patronage in the entrepreneurs of the budding French industrial revolution in the 1830s. Fascinated with mechanization and modernization, Bonhommé painted mills, factory techniques, workers, engineers, and factory visitors. A follower of Saint Simon, he was convinced that the poor of France could be aided only through industrialization. His Realist murals and paintings glorify the transformation of the French landscape by factories, and depict labor and capitalist harmoniously joined to promote social well-being. As disillusionment and strikes marred this idyll in the later part of the century, a disheartened and impoverished Bonhommé, along with his work, was relegated to obscurity.

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SCIENCE AND TECHNOLOGY STUDIES: TORONTO-80,

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THE WINTER 1981 ISSUE OF ALTERNATIVE FUTURES:

The Journal of Utopian Thinking will be devoted to the topic "Political Vision and the Future of Governance." Contributed papers should consider the content and implications of visions of governance in utopian and futurist literature, speculate on the future of politics or describe and consider possible and preferred forms and processes of governance in the future. Papers may take any position or approach and may represent any discipline, so long as they address the general theme.

Individuals interested in preparing a contribution for this special issue should send a one page prospectus to the guest editors as soon as possible. Individuals with a manuscript available for review should submit it no later than August 15, 1980.

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COURSES BY NEWSPAPER

announces the development of "American Families in Transition" and "The Nation's Health." "Families" will be offered during the fall of 1980 and "Health" in January 1981.

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Among the outstanding authors for this series are Robert S. Weiss, Professor of Sociology at the University of Massachusetts and Lecturer in Psychiatry at the Harvard Medical School; Jessie Bernard, Research Scholar of The Pennsylvania State University; and Kenneth Keniston, Professor of Psychology at the Massachusetts Institute of Technology.

"The Nation's Health" will consider the growing criticism of our system of health care and assess the reasons behind it. The various aspects of the health care system will be examined, along with its value and cost and its availability to various sectors of our society.

Among those joining Dr. Lee in this assessment of medicine and health will be René Dubos, Professor Emeritus of Biology at Rockefeller Institute; Daniel Callahan, Director of the Hastings Institute of Society, Ethics and the Life Sciences; and Donald Kennedy, Provost and Professor of Human Biology at Stanford University.

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invites those interested in the practice and uses of impact assessment, including environment impact assessment (EIA), risk assessment, social impact assessment (SIA), and technology assessment (TA) to join in the formation of a professional association dedicated to the advancement of the practice of impact assessment. Plans for the association are still in the formative stage and further information can be obtained and suggestions made by writing to: Alan Porter or Fred Rossini, Georgia Institute of Technology, Atlanta, GA 30332.

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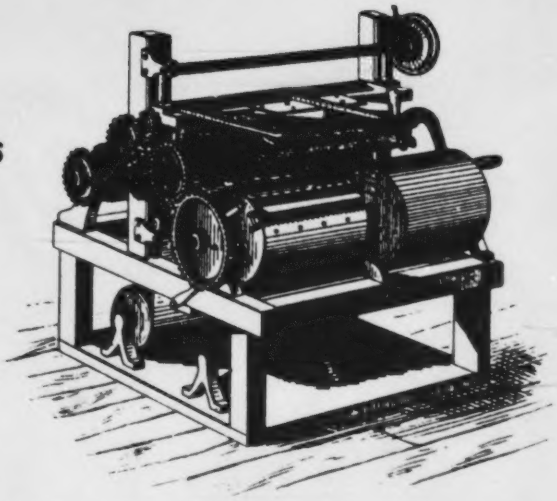

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program

Director: Steven L. Goldman
Editor: Stephen H. Cutcliffe

Number 19
September 1980

PRODUCT DESIGN FOR A SUSTAINABLE FUTURE: A MATTER OF ETHICS?*

Because of resource scarcity, environmental constraints, and changes in ethical and moral perceptions, our root values are in process of change whether we like it or not. The contemporary scene is quite different from John Locke's seventeenth century theory of individual liberty, Adam Smith's eighteenth century laissez-faire economics, or Jeremy Bentham's nineteenth century utilitarianism. It can be argued that the realities of our times are forcing a reevaluation of these fundamental values. Locke's, Smith's and Bentham's views were reactions against entrenched institutions and vested interests of the old feudal society that was breaking up around them. Analogously it might be postulated, that a good bit of the ferment that exists in the world today over resource scarcity, environmental issues, food, and related problems such as inflation, is a part of the process of transition to new concepts and institutions more appropriately equipped to deal with this new reality.

We simply no longer live in Adam Smith's world where "free market forces" automatically work to our benefit. Benefit is a value concept that is being questioned today as never before. The scale of our institutions and technologies have grown to gigantic size with extensive interconnections and dependencies. Populations have exploded around the world, in large measure attributable to the fruitfulness of science and technology. The populations have ravenous appetites whetted by institutions that seek to convince us that salvation is to be had with the acquisition of the latest shiny new product. When consumption of these new products slacks off, we find it increasingly difficult to provide jobs for our people. All of this in a world where there are no more virgin continents exploding with untapped resources. The carrying capacity limits of the environment are being pushed by assaults of waste streams driven by our consumptions. Governmental actions to cope with health and environmental problems produced by our appetites, helps somewhat with the employment problem by creating government jobs to correct for "market deficiencies" and "external diseconomies." But, growth of government is bemoaned and said to be inflationary and inefficient. Some are suggesting that Adam Smith's "invisible hand" has turned into an "invisible foot" that threatens to destroy the common good (air, water and land) with pollution and other externalities.[1]

Some contemporary economists and others, who are still not heard very loudly by their economics colleagues, are attempting to call our attention to the entropic nature of our economic processes.[2] The economic process is entropic in that we extract high quality (low entropy) non-renewable resources from nature and diffuse them in extraction, production, consumption and disposal into irretrievable waste products (high entropy) in the air, water, and land. This process cannot go on forever. Unfortunately, the idea of growth in production and consumption is built into the entire fabric of our society including our philosophical premises. To suggest a slowing of the rate of consumption flys in the face of the glue that has held the system together in the past. So long as the "pie" has expanded, conflict within and between groups has been contained reasonably well.

There are two paths we might follow in attempting to adapt to contemporary and likely future circumstances. (A) We can continue to believe that the future will be but a mirror of the past, and that use of virgin resources can grow to 200+ pounds/person/day by the year 2000. If we hold this view our focus will be on the "supply" end of things --how to arrange, through force if necessary to have a sufficient supply; how to improve and focus our science and technology so as to more efficiently extract needed materials from our own lower quality virgin deposits; how to find suitable substitutes for scarce materials, etc. Price increases will assist in this process.

Alternatively, (B) we can recognize that there are probably some limits, and ask ourselves as engineers and scientists how we might create products and technology so that they are less consumptive of virgin materials, and less destructive in an ecological sense. If we hold view B (a conservation view) our actions and focus will be quite different than if we hold view A.

Since paths are usually never polar as outlined above, the direction we take will probably be some combination of A and B. Unfortunately, because of trajectories set in the past, view A still dominates even though much lip service is presently given to the conservation view.

Even should view B grow in strength, we know that it is not sufficient that engineers and scientists apply their creative energies with new design criteria --products designed for a more sustainable future. Institutions and individual consumer patterns and attitudes must also change. Government is one piece of the "pie" (in addition to price increases) for bringing about institutional and attitudinal change. In our complex technological society, the basic framework within which economic and technological action takes place is established by government with its tax policies, health and environmental regulation, energy and hosts of other policies. Governmental policies when appropriately focused and implemented can be helpful in encouraging the conservation view.

Taking the conservation view, there are many ways in which technology can be designed so as to be less resource consuming and less environmentally destructive. To list a few of these options, products can be designed so that --(a) less material is used initially --smaller size, more sophisticated design approaches, etc.; (b) they have greater durability, reduced wear, less corrosion, etc.; (c) they can be more easily repaired; (d) they are more easily adapted for alternative use after the primary design use has been fulfilled; (e) they can be more easily recycled as products (remanufactured --inner loop recycled); and (f) they can be more easily and efficiently recycled to basic reuseable materials (outer loop recycling).

Although there appears to be some growth in product recycling (remanufacturing) within the USA, there are still many issues in need of further exploration. Some of these areas include: (a) life cycle energy dimensions; (b) material consumption implications; (c) waste and pollution reduction implications; (d) employment impacts; (e) quality and reliability characteristics; (f) life cycle cost from a consumer perspective; (g) standardization of components and parts; (h) product style updating; (i) leasing of products; (j) design criteria for remanufacturability; (k) international dimensions of product recycling; and (l) public policy considerations to encourage product recycling.

Should further exploration of "product" recycling indicate the desirability and feasibility for government to increase or change its involvement, there are several options --all of which need more analysis. These possibilities include: (a) deposit charges; (b) tax changes; (c) direct regulation; (d) labeling and warranty policy; (e) advertising and promotion; (f) education and information; (g) federal, state, and local government procurement; (h) governmental refurbishing of the durable products it uses; (i) capital availability; (j) labor force policy; and (k) others.[3]

Although engineering and scientific change are needed to help us move toward sustainability, institutional change is also needed. Let us illustrate with one example. We have developed an amazingly effective distribution and delivery system for spreading and diffusing the products from our factories all across this nation —and the world. Unfortunately "market forces" have not worked to establish an equally effective "disdelivery" system-- a collection system to channel the flow of old and discarded products back to appropriate centers for recycling to basic materials, or for recycling as products. Thus, the governmental policy idea of "deposit charges" is of interest as a possibility for encouraging the development of an efficient "disdelivery" system. This idea is fundamental to all well designed beverage container deposit laws. It was implemented in Sweden in 1975 to channel the flow of old automobiles back to appropriate recycling centers.

It seems appropriate to close with some questions about engineering education for a sustainable future.

1. Should we in engineering education be doing more, or doing things differently in our education of fledgling engineers relative to theory and design for a sustainable future?
2. Should we be concerned with continuing education of practicing engineers relative to these ideas?
3. If the answer to questions (1) and (2) is yes, then what might we do in engineering education to strengthen the conservation ethic in engineers?
4. Is it appropriate to think of "design for sustainability" in terms of professional licensing?
5. If we think more could and should be done in educating engineers relative to these ideas, can we do it ourselves? Or, would some kind of governmental action be helpful? If so, what kind?

The above are not idle questions. Indeed, it has recently come to the author's attention that the West German government is asking such questions relative to the education of engineers, architects, and skilled craftsmen. The focus in Germany is on energy conservation. Should we not broaden the focus to include other virgin non-renewable materials in addition to energy substances?

Is the idea of product design for a more sustainable future a matter of ethics, or is it simply a response to pragmatic circumstance --or is it some of both?

°°Professor Charles Overby
Industrial and Systems
Engineering Department
Ohio University
Athens, Ohio 45701

Footnotes

1. William Ophels, *Ecology and the Politics of Scarcity*. San Francisco: W. H. Freeman, 1977.
2. Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process*, Cambridge: Harvard University Press, 1971; Kenneth Boulding, *The Meaning of the Twentieth Century*. N.Y.: Harper and Row, 1964; and Hazel Henderson, *Creating Alternative Futures: The End of Economics*. N.Y.: Berkley Publishing Corp., 1978.
3. For further information on these points see Charles Overby, "Product Design for Recyclability and Life Extension," *ASEE 1979 Annual Conference Proceedings*, pp. 181-96 and "Scarce Resources: Technology Assessment and Materials Policy: A Year With the Office of Technology Assessment," *Ibid.*, pp. 163-72.

* *This article was abstracted with the author's permission from a longer version presented at the American Society for Engineering Education Annual Conference held at the University of Massachusetts in June 1980.* SHC

Science and Technology in the Public Administration Curriculum

Traditionally, schools of public administration and public policy have been concerned with four aspects of science and technology: (1) science policy at the federal level; (2) the role of technological innovation in public organizations; (3) the role of science and technology in economic development; and (4) the transfer of technology to underdeveloped nations. Yet, changing attitudes toward science and technology as well as the increasing role of government in the regulation of high technology industries have placed new demands on professional education.

Public officials are being confronted with tasks that require an understanding of science and technology at all levels of government. The responsibilities of federal agencies, once limited to supporting the development of new technologies, has been expanded to include vast new planning and regulatory functions. At the state and local level, public agencies have attempted to apply technology to public services as a means of improving productivity. Debates and controversies involving the deployment of new technologies have occurred in a variety of forums. These controversies have imposed new demands on public officials to serve as conflict-managers and mediators; a role for which few are adequately prepared or trained.

The technology-based tasks of public officials, once largely confined to the management of technological enterprises or to decisions regarding a specific technology, have clearly broadened to include new responsibilities. Knowledge about technology has become an integral aspect of almost all public sectors, e.g., health, energy, transportation, etc. As a result, all public administrators are faced with the need to understand and evaluate technologies as a basic element in decision-making processes.

Intelligent and informed decisions concerning technological issues requires four basic skills: (1) an ability to identify the information necessary for decision-making; (2) an ability to consider and evaluate technological alternatives; (3) an ability to communicate with scientific and engineering communities; and (4) an ability to effectively inform the public about risks and benefits of various technologies. These can be considered to be the minimum skills required by public administrators to achieve "technological literacy."

The following syllabi outline two courses oriented toward students of urban planning or urban public policy. The course titles are *Technological Issues in Public Policy and Administration* and *Technological Change and Urban Policy*. They are designed to provide students with an ability to: (1) recognize a technological question; (2) utilize scientific and technological information sources; and (3) exercise critical judgement in working with technical experts.

The courses are part of a project conducted by The Maxwell School of Citizenship and Public Affairs, Syracuse University; the Harriman School of New York, SUNY-Stony Brook; and the Graduate School of Public Administration at New York University under a grant from the Alfred P. Sloan Foundation.

°°Prof. Mitchell L. Moss
Graduate School of Public
Administration
New York University
4 Washington Square, North
New York, New York 10003

COURSE SYLLABUS

TECHNOLOGICAL ISSUES IN PUBLIC POLICY AND ADMINISTRATION

P11.2171
Spring 1980

Prof. Michael Tyler
New York University
Grad. School of Public Admin.

The aim of this course is:

> "To analyze public policy issues that arise from technological innovation or which have a major scientific or technological content; to demonstrate that these issues and the necessary background knowledge can be understood by the analytically minded non-specialist; and to equip students with the skills and experience to confidently tackle problems of this kind."

The course is based on case studies of real public policy issues and choices. The case study material includes selected technical and scientific literature intended to familiarize students with the selective and discriminating use of such literature by people from outside the specialist fields concerned. The sequence of case studies is designed to illustrate general themes common to many different technologies and policy topics. These general themes include:

- The relationships between social and private costs and benefits.
- The extent to which policy can anticipate events which mark a break from past trends, as opposed to merely reacting to these events retrospectively.
- The assessment and management of risk.

Required Books:

Most of the course materials will be provided in the form of case studies with associated background reading. However, the following provide essential background and orientation.

Joseph E. Piel and John G. Truxal, *Technology: Handle with Care.* New York: McGraw Hill, 1975.

Donald Schon, *Beyond the Stable State.* New York: W.W. Norton & Co., 1975.

Joel Primack and Frank Von Hippel, *Advice and Dissent: Scientist in the Political Arena.* New York: Basic Books, 1974.

Recommended Books:

Joseph Weizenbaum, *Computer Power and Human Reason: From Judgement to Calculation.* San Francisco: W.H. Freeman, 1976.

Course Requirements:

For each of the case studies a short written statement will be due before the class discussion of the case and in addition, a somewhat more intensive project or term paper will be required towards the end of the semester. Possible topics will be discussed in class and the results will be presented and discussed in class. All term papers are due on May 14.

Course Outline

1. *Introduction* (February 6).
2. *Analytics of risk and uncertainty* (February 13).
3. *Risk case study: Recombinant DNA laboratories* (February 20).

   What are the potential benefits and risks of research and production based on 'genetic engineering' (artificial manipulation of living organisms by modification of the chemically encoded information which controls cell reproduction)? What are the counterbalancing risks of inhibiting scientific enterprise? Should such work be permitted, and if so under what safeguards?

4. *Risk case study: rapid transit safety in the BART system San Francisco* (February 27).

   A retrospective case study of an advanced transit system with reliability problems. The BART case is especially relevant to understanding the relationships between 'expert', planner, and policy maker.

5. *Risk case study: the New York City black-out* (March 5).

   An example of the problems of reliability and vulnerability presented by large, complex systems.

6. *Urban technology lecture: land, sea and air transportation and their effect on the urban waterfront* (March 12).
7. *Impact of new technologies on employment and job satisfaction: analytic approach* (March 19).
8. *Employment and job satisfaction: recent research* (March 26).
9. *Employment and job satisfaction: case study* (April 9).
10. *The assessment of social and private costs and benefits: an introduction to analytical frameworks* (April 16).
11. *Costs and benefits case study: the "Swine Flu" vaccination program of 1976* (April 23).

    Illustrates the difficulties of anticipating outcomes of innovative policies, evaluating scientific evidence in such a setting, and associating economic valuations with the outcomes.

12. *Costs and benefits case study: investments in the telecommunications infrastructure in a developing country* (April 30).

    A composite case study based largely on experience in Africa, this case study illustrates issues of very general relevance (for example, 'consumption' versus 'growth' and 'income distribution' versus 'efficiency' as well as providing insights into technological planning in developing countries).

13. *Anticipatory planning: approaches to forecasting and planning for 'discontinuous' change/urban cable television case study* (May 7).

    This session discusses how public policy in high-technology areas can be 'proactive' as well as merely 'reactive' and introduces a case study on urban cable television and the franchising process designed to illustrate and develop this theme.

14. *Anticipatory planning: direct broadcasting satellites* (May 14).

    Further discussion of anticipatory planning, with illustrative lecture on Direct Broadcasting satellites. Illustrates how governments and international agencies have sought to anticipate the practical implementation of Direct Broadcast Satellites: also provides some insights into the creation of international agreements about technological issues and the operation of the relevant public international organizations.

15./16. *Discussion of term papers* (May 21 and May 28).

COURSE SYLLABUS

TECHNOLOGICAL CHANGE AND URBAN POLICY

Pll.2404
Spring 1980

Prof. Mitchell Moss
New York University
Grad. School of Public Admin.

Required Texts:

Albert Teich, ed., *Technology and Man's Future.* 2nd edition. New York: St. Martin's Press, 1977.
G. Boyle, D. Elliot, R. Roy, eds., *The Politics of Technology.* New York: Longman, 1977.
W. Henry Lambright, *Governing Science and Technology.* New York: Oxford University Press, 1976.
Donald Schon, *Beyond the Stable State.* New York: W.W. Norton & Co., 1975.
The Urban Institute, *The Struggle to Bring Technology to Cities.* Washington, D.C.: Urban Institute, 1971.
Langdon Winner, *Autonomous Technology: Technics-Out-of-Control as a Theme in Political Thought.* Cambridge, MA: MIT Press, 1977.

Course Outline and Reading Assignments: (* = optional)

1. The Future Now (February 6).
   - 1.1 Todd LaPorte, "Politics and Inventing the Future: Perspectives in Science and Government," *Public Administration Review*, June 1967.
   - 1.2 Nicholas Wade, "For the 1980's, Beware All Expert Predictions," *Science*, Vol. 207, 18, January 1980.
2. Technology and Choice (February 13).
   - 2.1 L. Winner, *Autonomous Technology*, Chapters 1-5.
3. Alternative Approaches to Technological Change (February 20).
   - 3.1 L. Winner, *Autonomous Technology*, Chapters 6-8.
   - 3.2 A. Teich, *Technology and Man's Future*, pp. 93-228; pp. 354-369.
   - 3.3 Harvey Brooks, "Technology: Hope or Catastrophe?" *Technology in Society*, Vol. 1, 1979, pp. 3-17.
   - 3.4 Lyman Sargent, "Utopia and Dystopia in Contemporary Science Fiction," *The Futurist*, Vol. 6, No. 3, June 1972.
   - 3.5 G. Boyle, et al., *The Politics of Technology*, pp. 2-24.
4. The Federal Role in Science and Technology (February 27).
   - 4.1 H. Lambright, *Governing Science and Technology*, pp. 1-83; pp. 136-209.
   - 4.2 Walter Baer, et al., *Analysis of Federally Funded Demonstration Projects.* Final Report, Rand Corporation, April 1976, R-1926-DOC or W. Baer, et al., "Government-Sponsored Demonstrations of New Technologies," *Science*, May 27, 1977.
   - 4.3 G. Boyle, et al., *The Politics of Technology*, pp. 25-36; 68-75; 88-97.
5. The Management of Technology (March 12).
   - 5.1 A. Teich, *Technology and Man's Future*, pp. 229-277; pp. 301-354.
   - 5.2 H. Lambright, *Governing Science and Technology*, pp. 113-135.
   - 5.3 G. Boyle, et al., *The Politics of Technology*, pp. 109-161.

5.4 Todd R. LaPorte, "Nuclear Waste: Increasing Scale and Sociopolitical Impacts," *Science*, July 7, 1978.
*5.5 Alan Mazur, "Science Courts," *Minerva*, Spring 1977.
5.6 Donald N. Michael, "An Aesthetic for Technology Assessment," *Alternative Futures*, Spring 1978.

6. Innovation and Diffusion Processes (March 5).

6.1 G. Boyle, et al., *The Politics of Technology*, pp. 36-45; 76-87.
6.2 David Roessner, "Incentives to Innovate in Public and Private Organizations," *Administration and Society*, Vol. 9, No. 3, November 1977.
6.3 W. Henry Lambright and Paul J. Flynn, "Bureaucratic Politics and Technological Change in Local Government," *Journal of Urban Analysis*, Vol. 4, 1977, pp. 93-118.
6.4 Robert Yin, "Production Efficiency Versus Bureaucratic Self-Interest: Two Innovative Processes," *Policy Sciences*, December 1977.

7. Public Involvement in Technological Decision-Making (March 19).

7.1 G. Boyle, et al., *The Politics of Technology*, pp. 164-225; 319-328.
7.2 Langdon Winner, "The Political Philosophy of Alternative Technology," *Technology in Society*, Vol. 1, 1979, pp. 75-86.
7.3 Robert Warren and Louis Weschler, "Technological Federalism: Research and Development at the Local Level," *Politics*, 1972.
7.4 Donald N. Michael, "On Coping with Complexity: Planning and Politics," *Daedalus*, Fall 1968.
7.5 Hans R. Hussey, "Dealing with the Negative Social Consequences of Technology," *Technology in Society*, Vol. 1, 1979.

8. The Application of Technology to Urban Communities (March 26).

8.1 The Urban Institute, *The Struggle to Bring Technology to Cities*, 1971.
8.2 Kenneth Kraemer, "Technology and Urban Management: The Power Payoffs of Computing," *Administration and Society*, Vol. 9, No. 3, November 1977.
8.3 H. Lambright, *Governing Science and Technology*, pp. 84-112.
8.4 G. Boyle, et al., *The Politics of Technology*, pp. 248-255.
8.5 Stephen White, "Towards a Modest Experiment in Cable Television," *The Public Interest*, Summer 1968.
8.6 Peter Blake, "Mickey Mouse for Mayor," *New York*, Vol. 5, No. 6, February 7, 1972.
8.7 Donald Schon, "The Blindness System," *The Public Interest*, No. 18, Winter 1976.
8.8 James N. Danziger, "Computers, Local Governments, and the Litany to EDP," *Public Administration Review*, Jan./Feb. 1977.

9. Time, Space, and Distance (April 9).

9.1 Melvin W. Webber, "Urbanization and Communications," in G. Gerbner, et al., eds., *Communications Technology and Social Policy*, New York: John Wiley and Sons, 1973.
9.2 Kenneth Boulding, "The City as an Element in an International System," *Daedalus*, Fall 1968.
9.3 Barry Wellman, "The Form and Function of Future Communities," in L. Bourne, et al., *Urban Futures for Central Canada*, 1975.
9.4 Richard Meier, "The Metropolis as a Transaction-Maximizing System," *Daedalus*, Fall 1968.
9.5 Richard Meier, *A Communications Theory of Urban Growth*, Cambridge, MA: MIT Press, 1963, Chapter 3.

10. Role of New Information Technologies (April 23).

10.1 Lewis M. Branscomb, "Information: The Ultimate Frontier," *Science*, January 12, 1979.

10.2 B. Dervin, "Strategies for Dealing with Information Needs," *Journal of Broadcasting*, Summer 1976.

10.3 D. Bell, "Communications Technology for Better or Worse," *Harvard Business Review*, May-June 1979.

10.4 Richard Harkness, "Innovations in Telecommunications and Their Impact on Urban Life," in G. Golany, ed., *Innovations for Future Cities*, Urbana: University of Illinois Press, 1976.

10.5 Richard Meier, *Communication Stresses in the Urban Environment*, University of California Berkeley Working Paper.

*10.6 Herbert A. Simon, "What Computers Mean for Man and Society?," *Science*, March 18, 1977.

*10.7 Edwin B. Parker, "Networks for an Information Society," *Bulletin of the American Society for Information Science*, Vol. 2, No. 1, June/July 1975.

11. Communications Technology and Urban Development (April 30).

11.1 Ronald Abler, "The Telephone and the Evolution of the American Metropolitan System," in Ithiel de Sola Pool, ed., *The Social Impact of the Telephone*, Cambridge, MA: MIT Press, 1976.

11.2 Forrest Warthman, "Telecommunication and the City," *Annals of the American Academy of Social and Political Science*, March 1974.

11.3 Jean Gottmann, "Megalopolis and Antipolis: The Telephone and the Structure of the City," in Ithiel de Sola Pool, ed., *The Social Impact of the Telephone*, Cambridge, MA: MIT Press, 1977.

11.4 Karl Meyer, "Love Thy City," *Saturday Review*, April 1979.

11.5 H. Kerbo, et al., "Reestablishing Gemeinschaft," *Urban Life*, Vol. 7, No. 3, October 1978.

11.6 Robert Johansen, et al., "Electronic Meetings: Utopian Dreams and Complex Realities," *The Futurist*, October 1978.

*11.7 National Research Council, *Telecommunications for Metropolitan Areas: Opportunities for the 1980's*, National Academy of Sciences, Washington, D.C., 1978, pp. 1-38; pp. 81-87.

12. Public Uses of Telecommunications Systems (May 7).

12.1 Ithiel de Sola Pool and H. Alexander, "Politics in a Wired Nation," in I. Pool, ed., *Talking Back: Citizen Feedback and Cable Technology*, Cambridge, MA: MIT Press, 1973.

12.2 Kenneth C. Laudon, *Communications Technology and Democratic Participation*, New York: Praeger, 1977, pp. 1-49.

12.3 Mitchell L. Moss, "Cable Television: A Technology for Citizens," *Journal of Urban Law*, Spring 1978.

12.4 Mary Gardner Jones, "The New Telecommunications Technologies Answer to Consumer Information Needs," (Mimeo).

12.5 Thomas F. Baldwin, Thomas A. Muth, and Judith Sacton, "Public Policy in Two-Way Cable: Difficult Issues for a Developing Technology," in *Telecommunications Policy*, Vol. 3, No. 2, June 1979.

12.6 Harold Mendelsohn, "Delusions of Technology," *Journal of Communications*, Vol. 29, No. 3, Summer 1979.

12.7 Mark Foster, "City Planners and Urban Transportation: The American Response 1900-1940," *Journal of Urban History*, Vol. 5, No. 3, May 1979.

13./ Presentation of Papers (May 14 and May 21).
14.

CONNECTIONS:

Literature, Science, and Technology:

A Second Semester Freshman English Course

During the spring 1980 semester, several members of the English Department at Lafayette College offered an English 2 option called "Connections: Literature, Science, and Technology." Visiting Mellon Professor Henry Dan Piper had successfully introduced a smiliar course for seniors during the fall 1979 semester (see *STS Newsletter*, #16, February 1980, p. 16). Hence five of us --Jim Vitelli, Dave Johnson, Hana Wirth-Nesher, Susan Ward, and I-- decided to give the option a try with freshmen.

As humanists and English teachers, we naturally chose imaginative writing as the centerpiece of the course. But because English 2 is primarily a writing course, we did not look to the students for literary analysis. Taking our cue from Dan Piper's experience, we chose our readings on the assumption that the excitement of discovery could more readily be generated by literature than by expository prose. Yet we did supplement the reading of novels, plays, and poems with a recent anthology consisting primarily of essays: Frederick E. Mosedale's *Philosophy and Science: The Wide Range of Interaction* (Prentice-Hall, 1979). Containing pieces by some of this century's most influential thinkers, including Freud, Einstein, Russell, Mencken, and Skinner, the collection was especially valuable in that its contents were organized into groupings I found convenient in structuring my course.

I divided the semester into five units of three weeks each (with the last unit being one week short). During the first week of each unit, we discussed a work of literature; during the second, students gave reports, later developed into term papers, on individual essays from the Mosedale collection; and during the third, we focused on writing matters, revising essays which grew out of class discussions and readings.

In the introductory unit we discussed not only the two cultures but various directions in science and technology of which any educated person living in 1980 should have some awareness. The primary reading assignment for this section was the factual account (though it reads like a novel) of the discovery of the DNA molecule. James D. Watson's *The Double Helix* proved an excellent stimulus for speculative discussions on what man could possibly do now that he has the "key" to life and, more importantly, what he *should* --and should not-- do next.

The other four units focused on science and technology as these relate to religion, human nature, society, and ethics. Naturally, none of these is an exclusive category, nor did we try to make it so, but all offered ideas concerning the urgent issues of our century. To supplement the discussions of the relationship of science and religion which grew out of our reading of Jerome Lawrence and Robert E. Lee's *Inherit the Wind*, we saw the film version of that play. The writing assignment for this unit, which included readings such as Genesis, "Freud Explains Religion Away" (an excerpt from *The Future of an Illusion*), and H. L. Mencken on anthropology and religion, asked the students to attempt a reconciliation of the biblical account of creation with the theory of evolution. (Coincidentally, just as the students completed their essays, a news article appeared in the Easton *Express:* Ralph Wendell Burhoe, a Chicago theologian had been awarded the $206,000 Templeton prize for his work in reconciling Genesis and Darwin. Even deservedly good grades were not enough to appease my students: they felt that since they had just accomplished this very thing, they too were entitled to a more materialistic reward.)

In the "human nature" section, we read Burgess' *A Clockwork Orange*. In conjunction with this novel, students reported on essays exploring such concepts as free will, determinism, the existence of a soul, and the dehumanization of man. Burgess' title, suggesting the imposition of the mechanical on the organic, led naturally to a consideration of man's relationship to the machine and the question of whether man is master or slave. Charlie Chaplin's *Modern Times*, shown in connection with this segment, comically but effectively reinforced the seriousness of the threat of dehumanization, particularly through the sequence in which Chaplin, at work on an assembly line, is unable to stop his automaton-like movements even after the line stops.

All of the readings in this section of the course led to a discussion of man's changing role in society, and so we opened the next unit by reading Ibsen's *An Enemy of the People*. We talked at length about people's resistance to overwhelming scientific evidence: that cigarette smoking causes cancer, that seat belts save lives, that California is due for a major earthquake. We attempted to understand the conflict between man's need to persist in his quest for the truth and his need to continue his life free of the disturbances entailed by the consequences of discovery. One of the more pertinent selections from the Mosedale anthology in this unit was an excerpt from Pirsig's *Zen and the Art of Motorcycle Maintenance*, expressing the intentional ignorance of technology on the part of two people who depend on it but who refuse to relinquish the humanistic view of life they feel technology opposes.

Finally, with Ibsen's Dr. Stockmann serving as the model of the scientist who zealously insists upon society's acceptance of his discovery but who ultimately may be doing no one a service, we discussed the responsibilities and ethical limitations of the scientist and of society. In this section of the course, students reported on theoretical essays such as Bertrand Russell's "Can Scientists or Anyone Know Anything?". As a group we read two works of literature: Norman Mailer's *Of a Fire on the Moon* and Heinar Kipphardt's *In the Matter of J. Robert Oppenheimer*. The play was followed by Stanley Kubrick's satiric film, *Dr. Strangelove: or How I Learned to Stop Worrying and Love the Bomb*, crowning the semester with an outrageous but sobering vision of our potential. Others who taught the option approached it somewhat differently, using many of the same readings I did but also such texts as *Lives of a Cell*, *Frankenstein*, *Galileo*, *Zen and the Art of Motorcycle Maintenance*, "The Birthmark," "Rappiccini's Daughter," Pynchon's "Entropy," Pope's *Essay on Man*, and Frost's "Design."

Throughout the course, our role was not that of the specialist in science but rather that of the humanist committed to opening up some of the fundamental questions raised by scientific and technological advances which directly relate to changes in the way man looks at himself and the world. The course admittedly offered few answers, but we do not consider that a failing, for it certainly helped destroy biases and stimulate new thinking --all of which gave the students a basis for their writing and left us with the feeling that such questions would be well worth treating further in an upper level seminar. Probably the best testimony to the achievement of this course is the students' own comments. Leslie Koska ('83) represents the consensus when she writes: "Perhaps the most beneficial thing this course has done for me is that it has forced me to sit down and really think. Never before had I been asked to analyze any connection between science and literature. I am a chemistry major, so science and the study of science are indeed an integral part of my life. Now, however, I have come to realize that I have always had a very narrow view of science. Up until this point, I had never really contemplated any of the moral issues presently confronting scientific development, nor had I even given much thought to precedents previously fought over. I believed, perhaps rather naively, that everything just fell into place, without any opposition to the consequences of science and technology. After taking this course, I am now able to correlate my original views, knowledge gained through readings, and others' views into a more realistic opinion of what is actually going on."

°° June Schlueter
Dept. of English
Lafayette College
Easton, PA 18042

Course Syllabus

SOCIETY AND TECHNOLOGY: IMPACTS AND INTERRELATIONSHIPS - 1890-1980

SS 261
Fall Quarter 1980

Prof. Mark H. Rose
Department of Social Sciences
Michigan Technological University

Lectures and readings in this course will explore the relationship between technological change and the shaping of American society during the course of the past century or so. Equally, we will investigate the influence of social, political, and economic ideas and practices upon the development of technical systems. The growth of transportation facilities and urban centers --among several items-- will serve as focal points, especially as they have influenced family patterns and housing. This course, then, should encourage an examination of the values underlying technical networks --promoting change in some features and persistence in still others-- and the counterpart place of technical values in molding the historic dimensions of contemporary American life.

Required Readings (available at the bookstore in paperback).

Carl W. Condit, *Chicago, 1930-1970: Building, Planning, and Urban Technology* (University of Chicago Press, 1974).

James J. Flink, *The Car Culture* (The MIT Press, 1975).

Elting E. Morison, *From Know-How to Nowhere: The Development of American Technology* (New American Library, Mentor, 1977).

Reserve Readings (available on reserve in the library).

George H. Daniels, "Big Questions in the History of American Technology," *Technology and Culture* 11(Jan., 1970): 1-21.

Thomas P. Hughes, "Emerging Themes in the History of Technology," *Technology and Culture* 20(Oct., 1979): 697-711.

Paper.

Each student will prepare a paper, roughly 8-10 pages in length (typed, double space), that focuses on the historic development of a technological system such as telephone networks, highways, water, gas, or electric utilities, mining operations, or sewerage treatment plants and on its social, economic, and political significance. You should also seek to explain the influence of local economic, social, and political customs on engineers, business leaders, and others who were active in constructing these systems. You might prepare this paper in the form of a report to the President of a firm in the industry, concluding with a brief (two paragraphs) policy recommendation. Topics, sources available in our library, and organizing ideas will be discussed in class. A bibliography and outline of this paper, approximately 3 pages in length, are due during the fourth week; two copies of the final paper are due at the end of the ninth week.

Walking Tour:

Provided that our schedule and the weather cooperate, we will take a walking tour (roughly 50 minutes in length) of one or two areas near the university. We want to look at the location of streets, rail lines, and the bridge, at the design and interior arrangement of homes, offices, plants, and at the use of building materials (architecture, broadly defined), and thus at the historic relationship between technology and society in Hancock-Houghton. In particular, I want you to join with me in "reading" technical artifacts as expressions of values and decisions in their social context.

Slide Essay (extra credit).

You might volunteer to prepare a slide essay of historic technical-social developments, whether in Hancock-Houghton or in another locale. As an illustration, prepare slides (40 or so should do nicely) and a brief, accompanying script (identification, date of construction, location, and significance) of a central electric operation —including prime movers, generators, transmission and distribution lines, a substation-- and the attachment to industrial plants and household appliances. So much the better for our purposes if you are able to locate, say, historic prime movers and "old" electric refrigerators.

Class Schedule.

Week 1 - Class organization; What Americans believed: Core Values in American life; What is technology and what is technological change? What is society and what is social change? In what direction have social and technical systems changed?

Weeks 2 - 4 - 1890-1917: The Systems Builders: Business, Technology, and the Shaping of Modern American Cities and Villages in America.
The growth, social patterns, and arrangement of "walking cities".
Inventors, Innovators, and Systems: Thomas A. Edison and Henry L. Doherty.
Electric lines, sewers, oil, transport, and the reversal of the urban order.
Early days in the automobile industry; the social bases of the auto's popularity.
Electricity, natural gas, architecture, and the sequestered home.
Going back downtown: Technologists and reform in the public and private traditions.
Technology at home, Part I: Liberation? A day at Coney Island.
Note: 20 minute Quiz, week 3; draft of paper due, week 4.

Weeks 5 - 6 - 1917-1929: Herbert Hoover, Alfred Sloan, Chalres Lindbergh, and the all-Electric Kitchen. Transport shortages, fuel shortages, and social consequences.
Reshaping General Motors. The persistence of heroes.
The modern home; Technology at home, Part II: Liberation yet?
The housing and auto industries and income distribution. Collapse of the economy.
Note: mid-term exam, week 5.

Week 7 - 1930-1939: Monopoly, Raymond Loewy, and the New York World Fair.
The Technocrats. Technology, business, and politics: New Deals for the high-technology industries. Redesigning America: New Towns and old ones.

Week 8 - 9 - 1940-1970: Electricity, the Interstate High System, and Space.
Technology at war: The East Winds Messages and the cultural confines of technical systems.
Suburbia: Technology on the urban periphery, Part III: Liberation yet?
Serving themselves and motorists: Engineers in politics. Going to the moon.
Note: Paper due, week 9.

Week 10 - What is this Age? Society, Culture, and Technology in the 1970s.
Technological innovation and the pace of economic growth.
Energy, Heat, and the Social Order: Are there limits to economic growth through technology?
The idea of the individual in a bureaucratic environment.
Final exam during exam week.

Reading Schedule

Weeks 1-3	Weeks 4-5	Weeks 6-8	Weeks 9-10
Morison, pp. 1-67	Morison, pp. 68-92	Morison, pp. 95-138	Morison, pp. 139-177
Flink, pp. 1-112	Flink, pp. 113-233	Condit, pp. 1-204	Condit, pp. 205-281
Hughes, pp. 697-711	Daniels, pp. 1-21		

BOOK REVIEW

Bugliarello, George and Dean Doner, eds. *The History and Philosophy of Technology.* Urbana: University of Illinois Press, 1979. xxxi, 384 p. $17.50.

This anthology brings to print more than twenty papers delivered at the Symposium on the History and Philosophy of Technology held at the Chicago Circle campus of the University of Illinois in May 1973. The symposium, funded by private foundation money, was viewed as "an end unto itself, an opportunity for historians, engineers, and philosophers to exchange views and to become sensitized to the contributions that their own disciplines could make to the other disciplines" (p.xi). Beyond that, the organizers hoped to bring historians and philosophers of technology together at a time when both disciplines remained in a formative stage and major conceptual gaps did not yet separate them, as had happened with historians and philosophers of science.

It is very refreshing and in many ways quite useful to have an anthology with such enviable goals: in going beyond the usual disciplinary formulations, to address questions concerning the value-laden decisions inherent in the development of technology and thus to examine from many points of view the historical technology-society dialectic. Unfortunately, only about half of the papers succeed in this endeavor. The remainder, while they may make contributions to their respective fields, add little to the cross-disciplinary discussion.

It is not possible to deal with all of the papers in the volume individually, but I would like to mention a few which I think will be of most interest to historians, philosophers, and students of science/technology/society interactions. In "Toward a Social History of Technological Ideas: Joseph Black, James Watt, and the Separate Condenser," Arthur Donovan illustrates how social and intellectual environment can influence the development of technology, in this case through attitudes toward both the attainment of understanding and the pursuit of improvement. He shows effectively how 18th century Scotland, whose "integrated and balanced cultural life" (p.29) valued philosophy and mechanics, sustained the interests of these communities and promoted their interaction.

Nathan Rosenberg's "Technology, Economy, and Values" examines the influence of personal and public values on the development of technology as well as the effect of changing technology on the values themselves --a true dialetic. While this was certainly a timely essay when it was written in the early 1970s, it now restates issues which have been treated in depth in both the popular and scholarly press. Yet, as a concise economic interpretation of technology, values, and the choices that follow from their interaction, it remains quite valuable, especially for students.

George Bugliarello, co-editor of the volume and himself an engineer, makes a strong argument for engineers to study the history of technology in order to understand the complex interactions of technology and culture. In his paper "The Engineer and the Historian," he places the burden on both engineers and historians to bring a fully realized history of technology to engineering education and asks historians to deal with technology in ways (systematic, data-based) that engineers can understand and appreciate. While historians might counter that their most important job is to help engineering students understand history from a non-engineering perspective, Bugliarello's argument provides the basis for bringing the camel's head well inside the tent.

In "Praxis and Techne," Peter Caws tells us that "the philosophy of technology can scarcely as yet be said to exist; what passes for it usually amounts to no more than inserting technology . . . as a boundary condition into some other branch of philosophy . . ." (p.232). Caws' paper is a delightful exception.

He works with the basic concept of praxis -- which he defines in terms of man's elemental relationships to the material world where he functions -- and shows how this relates to the "planned, purposive, relatively complex . . . sequence of praxes" (p.233) called technology. Caws goes beyond the analytical approach and argues quite effectively by resort to historical example and everyday life.

Henry Skolimowski's "Philosophy of Technology as a Philosophy of Man" is a forceful call to re-examine the positive values associated with change in western thought. He explains why, having missed the "promised land" (p.334) with modern technology, we must go beyond the western world view shaped by scientific and technical rationality to new perceptions on the place and uses of technology. Skolimowski wants to see philosophy of technology consider "basic presuppositions, assumptions, and modes of thinking, which, at least in part, led to our present predicament" rather than being confined to the "comfortable . . . problems which our analytical techniques allow us to tackle, and thereby acknowledge our intellectual impotence . . ." (p.335). While certainly addressed more to philosophers than to historians, this paper raises issues that need to be dealt with by both.

A few other particularly provocative papers are: Heather Lechtman and Arthur Steinburg, "The History of Technology: An Anthropological Point of View" (Aiming at anthropologists and archeologists, they argue that an understanding of cultural behavior comes through analysis of a society's technology); Werner Koenne, "On the Relationship between Philosophy and Technology in the German-speaking Countries" (This is a well-conceived discussion of how social and intellectual forces kept philosophers from understanding the place and importance of technology in the development of values); and Heinz Von Foerster, "Where Do We Go From Here?" (Suggesting that we must learn to integrate world forces into our being rather than viewing them as hostile, the author shows that our present attitudes toward science and technology reveal the outlook of the classic schizophrenic).

This discussion of a few papers should suggest the diversity to be found in the volume. There is, almost literally, something for everyone who is concerned with the history and philosophy of technology or more general studies in technology-society interactions.

One distinct problem with the book is segregation of the fields. First we are presented with the historical papers, then with the philosophical ones, and finally with a short section on "The Future of Technology." This tends to reinforce the historical-philosophical dichotomy. If the readership were confined to historians and philosophers, it would not be so serious a problem. But the general reader, and particularly the science/technology/society student, will find the desired synthesis rather difficult to achieve. This is not to say that the book fails in its aims, but that the structure, in representing traditional disciplinary lines, works strongly against them.

Finally, let me say that the book suffers from too great a leniency on the part of the editors. Given the purpose of the anthology, a number of papers which are very narrowly focused along disciplinary lines -- no matter what their pretentions -- would have been better left out, and some of those included might have been pared considerably. Yet, even the strictly disciplinary papers will serve an important purpose if they warn perceptive readers of the limits to the narrowly-focused approach in understanding the development of technology in society -- a complex process that works on many levels and does not confine itself neatly to any one disciplinary approach.

--Leonard S. Reich
Thomas A. Edison Papers
Rutgers University
New Brunswick, NJ

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BADGER, REID. THE GREAT AMERICAN FAIR: THE WORLD'S COLUMBIAN EXPOSITION AND AMERICAN CULTURE. CHICAGO: NELSON HALL, 1979. 117P. ILLUS., BIBLIOG.

A historian of American culture studies the World's Columbian Exposition to determine how it reflected the "psychological and emotional condition of American society in the 1890s" and to interpret its meaning in such a context. Badger considers the "vision of unity" suggesting idealism and order achieved through the design, plans, and architecture, as well as the effect of the celebration of technology, factory management, and electricity. A need for reassurance is found to be a major directing force as the White City arose out of the swamp. The creation of the fair is chronicled from idea, through organization, financing, and promotion, to the actual exhibits. Illustrations are useful with detailed photographs of architecture, the midway, the Ferris wheel, and an effective shot of the site after demolition.

DUDERSTADT, JAMES J. AND KIKUCHI, CHICIRO. NUCLEAR POWER: TECHNOLOGY ON TRIAL. ANN ARBOR, MI.: UNIVERSITY OF MICHIGAN PRESS, 1979. 228P. $8.50.

The authors are nuclear scientists who offer a "scientific" analysis of "the most significant decision criteria" surrounding nuclear power policy making: is there a sufficient resource base for the technology; is it socially and environmentally safe; is it economically sound? There answers to these three questions are: yes; yes; and only as a transition to an energy economy based on breeder and/or fusion reactors. Along the way to arriving at these answers, a useful, if very concise and persistently upbeat, account of the history, physics, and technology of nuclear power plants and of the fuel cycle is given. The fraction of the book given over to discussion of the proliferation question is substantial, and the final chapter discusses breeder and fusion reactors in some detail, yet can readily be followed by a general audience. S.L.G.

EDISON ELECTRIC INSTITUTE. ETHICS AND ENERGY. WASHINGTON, D.C.: EDISON ELECTRIC INSTITUTE, 1979. 83P. $2.50.

The ethical questions related to the decision of nations to continue the present course of economic growth and technological development are considered in a series of essays. Authors look especially at how ethical attitudes affect the decision-making process and the impact of large reductions in energy supply on life styles. Sam H. Schurr, co-director of the Center for Energy Policy Research, Resources for the Future, discusses theories about the convergence of energy, economic growth, and human welfare. Luther P. Gerlach views the growth debate from cosmic and grass-roots perspectives. J. C. Bradbury, U.N. technical advisor, relates Europe's experiences with severe electric shortages. A Director of Public Affairs Research at a power company analyses criticism of utility decision-making. An additional four articles on energy/environment round out the volume.

HAMILTON, WILLIAM. ELECTRIC AUTOMOBILES: ENERGY, ENVIRONMENTAL, AND ECONOMIC PROSPECTS FOR THE FUTURE. NEW YORK: MCGRAW-HILL BOOK CO., 1980. 425P. ILLUS.

Initiated under contract with the U.S. Department of Energy and conducted by a team at General Research Corporation, the detailed study measures future prospects, advantages, and disadvantages of the electric car. It considers technical features and costs; ability to serve the needs of drivers; marketing; effects on use of fuels and energy, air pollution, noise and other environmental considerations; the resources needed for batteries; and economic impact. The report is heavily supported by statistics. Some conclusions are that electric cars could serve the needs of urban drivers 95% of driving days, cost of such cars would remain higher than conventional vehicles and they would fail to capture as much as 10% of the market in this century, energy efficiency would depend on the basic source of energy, petroleum savings would be enormous with wide-spread use of these cars, reduced emissions from automobiles would in large part be accompanied by increased emissions from power plants while sulfur oxides in the air would increase, wide use would have little economic impact especially on jobs. Finally, the study determines that "a national shift to electric cars to conserve petroleum and improve the environment would be far more costly than already-adopted moves to low-pollution, fuel-efficient automobiles."

HIRSCHHORN, JOEL S. "RESPONSIVE TECHNOLOGY FOR IMPROVING U.S. INDUSTRIAL COMPETITIVENESS." TECHNOLOGY IN SOCIETY 1(NO. 4, 1979): 287-300.

The decline in U.S. industrial competitiveness that encompasses a loss in technological leadership and productivity is analyzed. Hirschhorn considers productivity and competitiveness to be complex measures. Industrial competitiveness is found to have three distinct aspects: resource competitiveness, technological competitiveness and international competitiveness. None of these can be achieved, he contends, if we continue our adherence to "autonomous" technology, the "singular," "congealed" technology that has dominated recent history. Rather, we must develop a "responsive technology" appropriate to an age of limited resources, economic and political restraints, and changing social values. The hostility that has characterized relations between government and industry cannot continue. Government must not only repress through regulation, but must also foster and stimulate research and development.

HOLMBERG, STEVAN R. PUBLIC UTILITY RESEARCH: A SYNTHESIS OF CURRENT AND CLASSIC ENERGY AND COMMUNICATIONS UTILITY RESEARCH. POTOMAC, MARYLAND: PMR PUBLISHING COMPANY, 1979. 303P.

The extensive but unannotated bibliography has been compiled to serve as a resource for public policy and management decision-making in the areas of regulation, marketing, and ownership of utilities. Coverage includes journal articles, law articles, books, and doctoral dissertations largely produced between 1960-1978 with "classic" materials prior to 1960. Engineering and technical research are omitted. Sections of the bibliography include: public utility regulation, operating costs, rate structure, management, marketing, finance and accounting, ownership. Two supplementary lists provide names and addresses of state and federal regulatory agencies as well as trade associations and research organizations.

JAKIEL, S. JAMES AND LEVINTHAL, ROSANDRA E. "THE LAWS OF TIME TRAVEL." EXTRAPOLATION 21(SUMMER 1980): 130-38.

In a graduate seminar in science fiction held at the University of Buffalo, students analyzed a number of works and attempted to distill a set of "laws of time travel" on the order of Asimov's "law of robotics." Though stories contradict one another, twelve laws generally appeared to hold true. Time travellers, it was found, cannot change history or bring things back from the future; however, they can change the future and return with artifacts from the past. The study by no means represents an exhaustive literature search, but it should prove inspiring in sci-fi course development.

JOHANSEN, ROBERT; VALLEE, JACQUES; SPANGLER, KATHLEEN. ELECTRONIC MEETINGS: TECHNICAL ALTERNATIVES AND CHOICES. READING, MASS.: ADDISON-WESLEY PUBLISHING CO., 1979. X, 244P. $15.95.

Electronic meetings are defined as those encounters in which "visual images, the spoken word or typewritten messages are exchanged electronically by people who may be far apart." Following a survey of the technology of teleconferencing, the volume probes the social potential of this new technology through presenting a future scenario in "Camelia," a developing nation facing a drought. Though optimistic about the utility of teleconferencing in such crises, the authors eschew more utopian visions of its promise.

KRANZBERG, MELVIN, ED. ETHICS IN AN AGE OF PERVASIVE TECHNOLOGY. BOULDER, COL.: WESTVIEW PRESS, 1980. 246P. $25.00.

The proceedings of a 1974 conference held in Haifa and Jerusalem features papers by prominent humanists, social scientists, and natural scientists. In Part I, authors generally agree that society's current difficulties are unparalled in magnitude, interconnectedness, political consequences, and universal scope. Technology has permeated social and political institutions, and is affected by as well as instrumental in shaping social values. Authors in the second session seek ethical systems suitable for the new age. Traditional Judeo-Christian ethics, ancient ethics, natural law, a "religion of science," ecological ethics, and "technoethics" are proposed. The social responsibilities of scientists, engineers, architects and institutions are addressed in the third part, while authors in the concluding section discuss prospects for joining morality to power. Appended is the "Mt. Carmel declaration of 1974," drafted in the final working sessions of the conference. Its ten tenets urge recognition of the threat of technology and the need for control. Developing countries are encouraged to avoid the follies of the West, while developed nations are urged to adopt "principled restraint" for their own growth. The need for "guardian disciplines" to monitor and assess technological innovations and impacts is stressed.

LONG, FRANKLIN A. AND OLESON, ALEXANDRA. APPROPRIATE TECHNOLOGY AND SOCIAL VALUES: A CRITICAL APPRAISAL. CAMBRIDGE, MASS.: BALLINGER PUBLISHING CO., 1980. 215P. $19.00.

Disenchantment with the concept of appropriate technology pervades Part I. Langdon Winner, having sketched the intellectual history of appropriate technology from Robert Owen to the New Alchemy Institute, suggests that, in purging ourselves of high technology, we may be exorcising the wrong demon. Harvey Brooks questions whether "hard technology" is necessarily impoverishing or environmentally degrading. In Part II, "Appropriate Technology in Practice," programs in several developing nations are examined. South Korea's success is attributed to a high level of government-industry cooperation, good technical information flow, and a policy of importing high technology and exporting industrial products. China's contrasting program of rural small-scale industry is profiled, along with less promising ventures in Ghana and India.

RESEARCH IN PHILOSOPHY AND TECHNOLOGY. VOLUME 2. ED. BY PAUL T. DURBIN. REVIEW AND BIBLIOGRAPHY EDITOR: CARL MITCHAM. GREENWICH, CT.: JAI PRESS, INC., 1979. 403P.

The European contribution to the philosophy of technology is the focus of the second volume of the annual of the Society for Philosophy and Technology. In Part I, Józef Bánka, a Polish philosopher, describes euthyphronics, the theory of adapting technology to men. Hans Lenk and Günter Ropohl, contending that philosophy should serve as a focal point for interdisciplinary discussion of technology, outline traditional and contemporary technological theories. Daniel Cérézuelle critiques the work of five French philosophers, including Jacques Ellul, who he says is virtually ignored in France. Part II offers a selection of papers read at Society for Philosophy and Technology panels at conferences held in the U.S. in 1976-7. Albert Borgmann writes about freedom and determinism in a technological setting; Edmund Byrne urges a pragmatic role for the philosophy of technology in solving problems posed by technology. The section also includes papers by Phillip Fanozzi on art, Bernard Gendron and Nancy Holstrom on the Marxist view of alienation and Michael Zimmerman's "Technological Culture and the End of Philosophy." A collection of historical papers is featured in the third part. Wolfgang Schadewaldt writes on the Greek concepts of phýsis and téchnē; Jacob Klein sketches the history of the concept "natura." A section of papers edited by Carl Mitcham presents the thought of French social philosopher Alfred Espinas and engineer Jacques Lafitte along with letters on Lafitte by Simone Weil. The concluding part of the volume is an array of review articles and bibliographies.

Alois Huning remarks on the Verein Deutsche Ingenieure's sponsorship of a whole spectrum of philosophical approaches to technology. Also reviewed are contemporary French and Dutch neoclassist movements and the literature of technology assessment (including a supplementary bibliography).

ROMAN, DANIEL D. SCIENCE, TECHNOLOGY AND INNOVATION: A SYSTEMS APPROACH. COLUMBUS, OHIO: GRID PUBLISHING CO., 1980. 495P. BIBLIOG.

The discussion of aspects of technological diffusion is geared toward managers associated with high-technology organizations (government and private), although this basic text serves well to assist in the clarification of the process of science and technology policy. "Macro" aspects of the management of technology considered include the economics of technology-government, organizational R and D, forecasting, appropriate technology, and the marketing of technology. The author then turns to "micro" components such as project selection and management, budgeting for R and D, mechanisms for control of technological innovation, and evaluation.

RYAN, CHARLES J. "THE CHOICES IN THE NEXT ENERGY AND SOCIAL REVOLUTION." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 16(MARCH 1980): 191-208.

Civilization's growth is viewed as successive advances in the control of energy through energy and social systems. Historically, energy "revolutions" in agriculture and fossil fuels demanded increased societal scale; traditional social structure was disrupted for benefits accrued from wealth and power. However, each "revolutionary" society reached a critical point at which growth could no longer be sustained, and smaller societies supplanted over-extended large ones. Ryan feels that the selection of fusion or some other large-scale energy form to supplant fossil fuels would result in increased social complexity and produce similar decline through overextension. Solar energy is seen as the means to a smaller-scale, but more stable future.

SCHRADER-FRECHETTE, K.S. NUCLEAR POWER AND PUBLIC POLICY: THE SOCIAL AND ETHICAL PROBLEMS OF FISSION TECHNOLOGY. DORDRECHT, HOLLAND: REIDEL PUBLISHING CO., 1979. 176P.

The author attempts a detailed and systematic articulation of the social, political, and ethical issues surrounding nuclear power specifically and public policy making in regard to technological innovation generally. The central concern is to elucidate the moral character of the methodologies, like risk-benefit analysis, that either explicitly or implicitly underlie discussions of the social impact of low-level radiation, nuclear waste, and catastrophic accidents. Ostensibly neutral-critical in its assessment of the logical consistency of pro- and anti-nuclear positions, this book is more likely to please adherents of the latter than of the former. S.L.G.

SCIENCE 209 (4452); JULY 4, 1980. 200P.

In the opening pages of this centennial issue, William D. Carey suggests that in an era of science journalism, Science has taken on the appearance of a "laced and corseted great-grandmother who is very sure of her position, and, despite her great age, entirely capable of keeping it." This special issue is itself worthy of special commendation. Scientific progress of several eras as recorded in the pages of the journal is profiled in five articles, followed by a collection of reviews of "present and future frontiers" in various scientific and technological fields. Concluding papers look at the interaction of science and technology with societal problems, examining population, food, energy, environment, and information.

SELFRIDGE, OLIVER G. AND SCHWARTZ, ROBERT T. "TELEPHONE TECHNOLOGY AND PRIVACY." TECHNOLOGY REVIEW 82 (MAY 1980): 56-62.

Telephone surveillance goes back almost as far as the invention itself, with the first infamous American interloper identified as a greedy 1889 undertaker. Selfridge and Schwartz contend that wiretapping is more wide-spread than ever before --and likely to become easier-- due to technical advances in telephone technology and continuing lax regulation. Scheming adversaries can also misroute calls, fake busy signals or create "phantom ringing." If we are to avoid phone booths for important calls, the authors contend, better utility record keeping and tighter government controls are needed.

VARGISH, THOMAS. "WHY THE PERSON SITTING NEXT TO YOU HATES LIMITS TO GROWTH." TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 16 (MARCH 1980): 243-56.

The assertion of the authors of Limits to Growth to the effect that limits exist and are inevitable has met widespread resistance. Those who accept the "Limits" view tend to attribute this resistance to personal greed, short-range thinking, or mindless optimism. Vargish, however, suggests that resistance to the concept of limits is "almost instinctive" and "primitive": the growth of the economy has, for our society, become synonymous with personal and social growth. To adopt a limits-to-growth viewpoint is to deny the intervention of Providence or the fortuitousness of historic process --"the only plan must be our own."

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Science, Technology and Society Program
327 Maginnes Hall #9
Lehigh University
Bethlehem, PA 18015

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program

Director: Steven L. Goldman
Editor: Stephen H. Cutcliffe

Number 20
November 1980

"THE TIME MACHINE":

COLLEGE - MUSEUM COLLABORATION AT WPI

Worcester Polytechnic Institute began to develop its program in college - museum collaboration, called "The Time Machine," in 1976. At that time the school had just introduced its new undergraduate degree program, which included a requirement that each student carry out a project relating science and technology to some aspect of society and human life. The project was called the Interactive Qualifying Project. Faculty in the Humanities Department soon explored the possibility of students doing such projects at museums. In the summer of 1976, with Professor Donald Johnson of the Humanities Department as coordinator and with the help of the Mellon Foundation, six faculty members visited museums in Massachusetts within easy reach of Worcester. They talked with staff at the Merrimack Valley Textile Museum, the Peabody Museum of Salem, the Worcester Historical Museum,and other institutions. The program, begun in 1977 with eleven students at four museums, has expanded considerably in the past three years.

Unlike some college-museum programs which involve formal course work or which develop skills in museumship, this program, as part of a student's regular academic load, attempts to demonstrate through a project approach how science and technology fit into an historical and cultural context. In addition to doing traditional research, students work in an ambience which houses unique holdings and artifacts, allowing an exposure to materials that would not otherwise be readily accessible. In fact, projects in "The Time Machine" program have met with greatest success at museums with adjoining research libraries. Cooperative work with appropriate museum liaisons, whose insights complement traditional academic perspectives, helps students to learn much about effective presentation to the public.

If students receive benefits that would not be possible in a traditional classroom setting, substantial benefits also accrue to the museums. Many museums are understaffed and cannot devote sufficient time to improving their exhibits, expanding their educational programs, developing their library holdings, or doing necessary background research on the collections of their artifacts and documents. More particularly, the technical training of WPI's science and engineering students has proven valuable in the design, construction, and mounting of complicated exhibits. Collaboration in this program has thus enabled museums to carry out significant projects that might otherwise be neglected. Each student project is approved by appropriate museum staff in the hope of improving offerings to the public.

Rather than placing students at off-campus agencies without close supervision, "The Time Machine" has placed a premium on the advising role of participating WPI faculty. Because all projects are interdisciplinary, it would be nearly impossible for a single faculty member to direct projects. Thus, each project is directed by two faculty co-advisors, one of whom works in a technical field and the other in a humanistic discipline. Because they receive direction and advice from two faculty members as well as from appropriate museum staff, students are able to explore more capably the complex interactions among science, technology, and culture.

Since its inception, "The Time Machine" has collaborated with nine museums in the New England area. The variety of participating museums reflects itself in a wide diversity of projects, ranging among the general subjects of literature, social history, maritime history, and history of technology. Students interested in nineteenth-century American literature and culture have worked at the Mark Twain Memorial (Hartford, Connecticut). An interest in maritime history has attracted students to project work at Peabody Museum (Salem, Mass.), Mystic Seaport Museum (Mystic, Connecticut), and Salem Maritime National Historic Site (Salem, Mass.). Projects on local industry have been conducted at Worcester Historical Museum (Worcester, Mass.), while the development of the textile industry has been the focus at Merrimack Valley Textile Museum (North Andover, Mass.). The industrial growth of small New England towns has been the topic of interest at Old Sturbridge Village (Sturbridge, Mass.). The formidable collection of arms and armor at the John Woodman Higgins Armory (Worcester, Mass.) has provided unique opportunities for projects in the technology of warfare. Students have studied the role of workers in the industrialization of nineteenth-century America at Slater Mill Historic Site (Pawtucket, Rhode Island). Because of the diverse needs of the respective museums, projects have involved varied efforts, ranging from traditional research, to public presentations by students, to temporary and permanent exhibits.

WPI's collaboration with the Mark Twain Memorial, for example, resulted in a temporary exhibit. Students and faculty advisors initially conceived a detailed study of the inventions of special interest to Mark Twain. With the serendipitous discovery of the original plans of the Paige Compositor, the only surviving model of which is housed at the Twain Memorial, the typesetting machine that plagued Twain's life and career became the centerpiece of the planned exhibit. The libraries of WPI and the American Antiquarian Society provided information on nineteenth-century typesetters and typecasters via an array of technical periodicals. This research provided necessary background for a comprehensive analysis of James W. Paige's machine. Research also continued on related topics: Twain's financial dealings with Paige, the three minor inventions Twain patented on his own, and the relationship between the machine and Twain's *A Connecticut Yankee in King Arthur's Court*. In addition to mounting a full-scale exhibit in the museum area of the Twain Memorial, students wrote a fully documented report, which also functioned as a guidebook to the exhibit. The report and the exhibit, entitled "The Writer Confronts the Machine," attempted to bring together biographical information, literary interpretation, and technical analysis in a coherent way.

Another temporary exhibit resulted from cooperation between WPI and the Merrimack Valley Textile Museum. The museum, which concerns itself with the history of textile processing, needed additional information on

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Dr. Stephen Cutcliffe, STS Program, 216 Maginnes Hall #9
Lehigh University, Bethlehem, PA 18015

dyeing during the period between 1850 and 1925. The goal of a student team was therefore to provide detailed information on the historical and modern aspects of dyeing. Because information on this subject was voluminous but diffuse, the students limited their topic to a "case-study" approach: Arlington Mills and Lowell Bleachery and Dye Works served to introduce dyehouses and processes for dyeing wool. In addition to examining processes by which color is added to raw stock or to woven material in a gray state, students also studied the safety and working conditions of the dyehouse, thereby observing a contrast between contemporary working conditions and those of the past. Related historical developments also received attention: the impact of immigration, the growth of unions, and the demands of striking workers. By analyzing a technical process within a sharply defined historical context, the students were able successfully to complete a report and exhibit. "The Dyehouse: A Treasure House of Color" appeared as an exhibition at both Worcester State College and WPI's Gordon Library.

The John Woodman Higgins Armory in Worcester is one of the more unusual museums at which students have worked. As one of the largest armories in the Western hemisphere, it houses an extensive collection of arms, armor, and martial artifacts, largely from the medieval and Renaissance periods. Foremost among the challenges at this museum has been the placing of weapons into the context of the society that constructed and wielded them. Thus, the most ambitious project at the museum,and one that demanded a broad range of historical methods to execute, analyzed the European tournament, the centerpiece of the chivalrous life, to present it to the public not only as a part of the history of technology but also as a facet of cultural history. This exhibit stemmed from the museum director's long-standing interest in the tournament, which had led him to suggest that a team of students design a display around a major artifact, a superb jousting suit constructed in 1535 by Valentin Siebenburger of Nuremberg.

After deciding to portray the technical aspects of jousting within the context of Renaissance court life, the students did much of their research in the armory's library. They soon discovered, however, that when they stepped outside the realms of heraldry and the history of the tournament as court spectacle, neither historians' analyses nor sources could answer many of their questions. One student, who read sixteenth-century manuals on horse training, practiced jousting on his own horse, the only way, he maintained, to experience what it must have been like to participate in a tournament. After completing their research essays, the team designed and constructed large illustrated panels with explanations of various aspects of the institution of the tournament: the history of the spectacle in England, France, and the German states; the Holy Roman Emperor Maximilian I as jouster; the heraldry of the knights; the armor and weapons used; the celebration of knightly combats in the works of court artists; and the types of horses ridden by combatants. The exhibit, entitled simply "The Tournament," opened to the public in May, 1979.

Occasionally, projects have been more technical in emphasis. One such project was undertaken at the Peabody Museum of Salem where staff had expressed an interest in an exhibit that could be placed in their maritime hall to explain vividly to visitors how the wind makes a boat sail. Two mechanical and three electrical engineering students undertook to design and construct a model boat, mounted in a wind tunnel, that could be controlled by an adult or child. At the outset, the students were forced to recognize and appreciate the problems of translating abstract ideas and physical concepts into forms that the public could understand. Hence in developing the exhibit, the electrical and mechanical design quickly became subservient to the educational purpose; "technology for education" became the key words. Constructed by the students, the historically accurate model of a Friendship sloop, a lobster boat popular at the turn of the century, can rotate through a complete circle and heel realistically in the wind. It is housed in a large transparent case. By joggling switches outside the case, a person can pull in or let out the two jibs and mainsail and can turn the boat into any position in the wind, which is generated automatically by touching the switches. In effect, the exhibit teaches a person how to sail. Thus, the Peabody Museum offered an opportunity to directly engage students in the important goal of translating maritime technology into a form that would help the museum visitor gain insight into the branch of cultural activity represented by the Peabody's collections of ship models and marine artifacts.

In recreating the nineteenth-century maritime life of New England in all its profusion, Mystic Seaport is another museum which has offered students a challenging array of possible projects. The first team to collaborate with the seaport focused on the ropewalk of the Plymouth Cordage Company that stands on the museum grounds, but which has remained a static display. By studying the history of ropemaking techniques and by examining the Plymouth ropewalk, the students were able to design and build a working model of the machinery at the seaport, thereby helping the museum staff to explain to the public how ropes were made. Another team studied navigational techniques, again with an eye to explaining to the public a technical skill in an historically accurate manner.

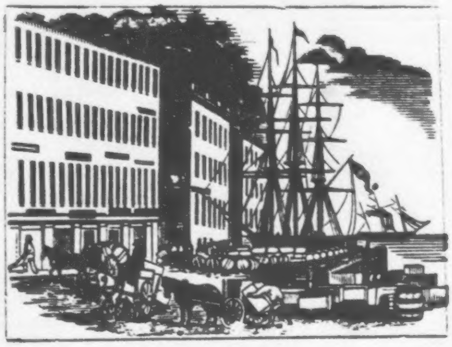
As the "Time Machine" program continues, both faculty and students are building on the experience of previous years. At present, students often bring to their projects knowledge and skills required in humanities courses, or they engage in preparatory study before embarking on their chosen project. To prepare students as thoroughly as possible, faculty in "The Time Machine," with the help of a grant from the Association of American Colleges, are now structuring a seminar that each student will take before choosing a particular museum. The preparatory seminar will examine the nature and role of archery in England and France during the Hundred Years War. By first examining longbows, crossbows, and the missiles shot from them, and by then applying technical, historical, and literary analyses of these artifacts, students should understand better the role of technology in society. Mandatory shooting at an archery range should help them empathize with medieval archers, while visits to the Higgins Armory in Worcester should introduce the students to the physical problems of working with artifacts and of transforming their technical, historical, and literary knowledge into exhibits that educate the public.

WPI looks forward to the continuation of "The Time Machine," with its benefits to museums, and remains confident that through college-museum collaboration the disciplines of the humanities can contribute uniquely to the professional education of future scientists and engineers.

E. Malcolm Parkinson, Assoc. Prof. of History
Kent Ljungquist, Asst. Prof. of English

Humanities Department
Worcester Polytechnic Institute
Worcester, MA 01609

(Further information on "The Time Machine" Program may be obtained by writing directly to Professors Parkinson and Ljungquist.)



COURSE SYLLABUS

SCIENCE, TECHNOLOGY, AND PUBLIC POLICY *

Indiana University
Dept. of Political Science and
School of Public & Environmental Affairs

Lynton K. Caldwell
Robert V. Bartlett
Fall 1980

This course will cover historical relationships between government, science, and technology; organization for science policy in major governments; and political, administrative, and technical procedures through which public policy on science and technology is formulated. International programs for science and technology will be considered, and principle policy issues will be identified.

This course has two major purposes. The first is to foster student awareness of the significance of science and technology as social forces in modern societies, and to develop understanding of the crucial relationships between science, technology, and government. The second major purpose is to provide an overview and introduction to science, technology, and public policy as a field of study, for those students wishing to undertake further work in this area. Consequently, it will be necessary to cover a wide range of topics with a high degree of generality. Obviously, each of the topics outlined in this syllabus could easily be the subject of a full semester graduate-level course by itself; nevertheless, our purposes are better served by a greater comprehensiveness of scope.

This course is organized as a seminar, with the entire course grade to be determined by the quality of short weekly papers and class discussion. Weekly papers on assigned topics should be approximately three pages in length. A course paper on a subject of the student's choosing may be substituted for three of the weekly papers at the student's option. This paper need not be longer than ten to twelve pages and is due no later than November 24.

It should be noted that this course is being offered on the assumption that the primary goal of every student enrolling is to learn. Consequently, we fully expect students to have read each week's material before coming to class, to complete writing tasks on time, and to play an active role in the learning process by participating in classroom discussion. Part of the course grade will depend on whether or not students live up to these obligations. We have designed the grading system to encourage students to learn by doing: any paper submitted on time may be rewritten and resubmitted within two weeks of the original due date, with only the higher grade counting. In this way, students so interested may take advantage of insights provided by the instructors' comments, the class discussion, and further reflection.

A recommended reference for this course is provided by the publication *Science, Technology, and Public Policy: A Guide to Advanced Study* by Lynton K. Caldwell and Toufig A. Siddiqi. Each of the topics selected for consideration during this semester is outlined in the *Study Guide.* Unfortunately, this *Study Guide* is no longer available for purchase, but it may be consulted at the libraries.

The following written materials have been ordered through the bookstores and should be available for purchase. In addition to the readings, all students should plan to become regular viewers of two television programs on PBS: *Nova* and *Connections: Technology and Change.* These programs will be referred to regularly in class.

Required Books:

Bartlett, Robert V. *The Reserve Mining Controversy: Science, Technology, and Environmental Quality*. With Introduction and Concluding Observations by Lynton K. Caldwell. Bloomington: Indiana University Press, 1980.

Brecht, Bertolt. *Galileo*. Eric Bentley, ed. Translated from German by Charles Laughton. New York: Grove Press (Random House), 1966.

Daedalus: Journal of the American Academy of Arts and Sciences. Vol. 109 (Winter 1980) -- "Modern Technology: Problem or Opportunity?"

Durrenmatt, Friedrich. *The Physicists*. Translated from German by James Kirkup. New York: Grove Press (Random House), 1964.

Ellul, Jacques. *The Technological Society*. New York: Vintage Books (Random House), 1967.

Kuhn, Thomas. *The Structure of Scientific Revolutions*. Second Edition, Enlarged. Chicago: University of Chicago Press, 1970.

Medvedev, Zhores A. *Soviet Science*. New York: W. W. Norton, 1978.

Nelkin, Dorothy, ed. *Controversy: Politics of Technical Decisions*. Beverly Hills: Sage Publications, 1979.

Snow, Charles P. *Two Cultures and a Second Look* (An Expanded Version of the Two Cultures and the Scientific Revolution). London: Cambridge University Press, 1964.

Strunk, William, Jr., and E.B. White. *The Elements of Style*. Third Edition. New York: Macmillan Company, 1979.

Watson, James D. *The Double Helix: A Personal Account of the Discovery of the Structure of DNA*. New York: New American Library (Mentor Books), 1968.

Zinsser, William. *On Writing Well: An Informal Guide to Writing Non-fiction*. Second Edition. New York: Harper and Row, 1980.

Class Schedule and Reading List:

September:

1 *Introduction*.
Prerequisites for the course:
1. Zinsser
2. Strunk and White
3. Recommended: Mitchell, Richard. *Less Than Words Can Say*. Boston: Little, Brown and Co., 1979.

8 *Science, Technology and Public Policy: Some Issues*.
1. Durrenmatt
2. Brecht

15 *Science as an Aspect of Modern Culture.*
1. Snow
2. Steven Maynard-Moody, "The Fetal Research Dispute," in Nelkin
3. Dorothy Nelkin, "Creation Versus Evolution: The California Controversy," in Nelkin
4. Sheldon Krimsky, "Regulating Recombinant DNA Research," in Nelkin

22 *Scientific Work in Technological Societies: Molecular Biology.*
1. Watson
2. Recommended: Judson, Horace Freeland. *The Eighth Day of Creation: The Makers of the Revolution in Biology.* New York: Simon & Schuster, 1979.

29 *Scientific Work in Technological Societies: The Soviet Union.*
1. "The Lysenko Affair," *Nova*, 1974 (Media Center, Undergraduate Library)
2. Medvedev
3. Thane Gustafson, "Environmental Conflict in the USSR," in Nelkin

October:

6 *Scientific Work in Technological Societies: What is Science?*
1. White, Lynn, Jr., "The Ecology of Our Science," *Science 80* 1 (November-December 1979): 72-76.
2. Boulding, Kenneth E. "Science: Our Common Heritage," *Science* 207 (22 February 1980): 831-36.
3. Recommended: Diesing, Paul. *Patterns of Discovery in the Social Sciences.* New York: Aldine, 1971.

13 *Scientific Work in Technological Societies: What is Science?*
1. Kuhn
2. Terence Ball, "From Paradigms to Research Programs: Toward a Post-Kuhnian Political Science," *American Journal of Political Science* 20 (February 1976): 151-77.
3. Recommended: Thomas Kuhn. *The Essential Tension.* Chicago: University of Chicago Press, 1979, especially pp. 266-339.
4. Recommended: Imre Lakatos and Alan Musgrave, eds. *Criticism and the Growth of Knowledge.* London: Cambridge University Press, 1974, especially pp. 91-196.

20 *Connections Between Science and Technology.*
1. W. O. Baker, "Science and Technology," in *Daedalus*
2. David Landes, "The Creation of Knowledge and Technique: Today's Task and Yesterday's Experience," in *Daedalus*

27 *The Social Impact of Science and Technology.*
1. Ellul

November:

3 *The Social Impact of Science and Technology.*
1. Ellul

10 *Policy Problems of Science and Technology.*
1. Dorothy Nelkin, "Science, Technology, and Political Conflict: Analyzing the Issues," in Nelkin
2. Jerome Milch, "The Toronto Airport Controversy," in Nelkin
3. Dorothy Nelkin, "Nuclear Pwer and its Critics: A Siting Dispute," in Nelkin
4. Susan Fallows, "The Nuclear Waste Disposal Controversy," in Nelkin
5. Susan G. Hadden, "DES and the Assessment of Risk," in Nelkin
6. Michael Brown, "Setting Occupational Health Standards: The Vinyl Chloride Case," in Nelkin

17 *Policy Problems of Science and Technology.*
1. Bartlett

24 *Regulation of Science and Technology.*
1. Judith Peppy, "The Automobile Airbag," in Nelkin
2. James C. Peterson and Gerald E. Markle, "The Laetrile Controversy," in Nelkin
3. Joshua Ira Schwartz, "Smallpox Immunization: Controversial Episodes," in Nelkin
4. Deborah Shapley, "Arms Control as a Regulator of Military Technology," in *Daedalus*
5. David K. Stout, "The Impact of Technology on Economic Growth in the 1980s," in *Daedalus*

December:

1 *Science, Technology, and Public Policy.*
1. Langdon Winner, "Do Artifacts Have Politics?" in *Daedalus*
2. N. Bruce Hannay and Robert E. McGinn, "The Anatomy of Modern Technology: Prolegomenon to an Improved Public Policy for the Social Management of Technology," in *Daedalus*
3. Harvey Brooks, "Technology, Evolution, and Purpose," in *Daedalus*

8 *Governing the Technoscientific Superculture.*
1. Elting Morrison, "The Uncertain Relation," in *Daedalus*
2. Daniel T. Spreng and Alvin M. Weinberg, "Time and Decentralization," in *Daedalus*
3. Walter Rosenblith, "A Note on Engineering and the Other Professions," in *Daedalus*
4. Edward E. David, Jr., "On the Dimensions of the Technology Controversy," in *Daedalus*

15 *Governing the Technoscientific Superculture.*
1. Robert S. Morison, "A Further Note on Visions," in *Daedalus*
2. Symposium, "Some Issues of Technology," in *Daedalus*

*[Editor's Note: This course is a graduate level course but also open to advanced undergraduates. It presumes that students have little prior background in political science, the natural sciences, or history and philosophy of science.]

THE MORAL DILEMMA OF THE SCIENTIST

I have just offered, for the fourth time, an advanced literature course on the moral dilemma of the scientist as depicted in modern drama. Contrary to some courses, which fade when given repeatedly, this one grows in interest and excitement for me with each offering, and as I read the latest issues of STS, I see that the questions which fascinate us in our literary studies are still being raised by other disciplines.

My literature course differs from Henry Dan Piper's (described in STS, Number 16) in that it is a drama course, concentrates on the literature of one nation (Germany), and stresses one theme among many: the character of the scientist and the dilemma he encounters upon striving to know more of the world and considering the moral and philosophical implications of his findings. I teach the course in both German and English (almost all of the plays are available in translation) and, in both cases, also discuss some significant British and American contributions to the theme.

In outlining the course here, I will state briefly: I. a basic premise concerning the nature of the scientist, II. the questions we ask in analyzing each play, and III. a syllabus and additional reading list. However, because space is limited, and in the spirit of what modern science has taught us, namely that "there is no absolute knowledge . . . . there is no God's-eye view" (J. Bronowski), I will refrain from presenting in detail the conclusions of our study. That will be left to each colleague who wishes to examine our topic for himself.

I. THE SCIENTIST

The archetype of this multi-faceted character in German literature comes from Goethe and has two faces: a. Faust, representative of "pure science", the seeker of knowledge for its own sake, and b. the sorcerer's apprentice, prime example of the dangers of applied science, technology gone wild. (While Goethe wrote this ballad in 1797 for very personal reasons, it is nonetheless relevant to our study, especially in plays such as *Gas* and *Oppenheimer*.)

It is, however, *Faust* which shows us what makes the scientist tick, and its key is the concept of "striving." Faust has seen "that nothing can be known!" and despairs of reciting "empty words" to his students. Having been unable to know the essence of reality through the traditional disciplines of the university, he turns to magic in hopes of quenching his striving: "'tis to detect the inmost force/which binds the world and guides its course,/all germs and forces to explore--/and band empty words no more!" It is this passionate striving for knowledge which makes Faust a model for our study, and for Goethe this trait is not only what distinguishes him, but also what ultimately saves him. Because of his striving, because he is fulfilling that God-given impluse (and in spite of the consequences), he will be saved.

The question of man's pursuing his curiosity, of striving to know the secrets of the universe, and of technologically applying his findings is, of course, a burning one today. Nuclear power, space flights, genetic engineering are all issues which entail the best and worst of man's striving nature. They are hotly debated, and the results are as different as the poetical images of Goethe and Bertolt Brecht. Specifically, after the Three Mile Island crisis, the debate about man's striving nature and the morality of pursuing it was clearly heard. Some said we should suppress the drive to explore and conquer nature, others, fearing annihilation of the noble (yes, noble) drive which has brought man from the Stone Age to the present, said that even a meltdown should not deter us from developing nuclear energy. "Man errs as long as he does strive," said God in Goethe's *Faust*. The question which we must pose and which several German poets have posed before us is, "can we in the industrial and nuclear ages survive when we do err? Conversely, can we survive as men if we don't strive?"

II. STUDY QUESTIONS

A. What is a scientist? Is he a special kind of person? Is he an outsider, on the periphery of society? Is so, then is he intentionally outside, or is he shunned and relegated to a special status? Is he different from the rest of us, or greater and better? Does he bear comparison with the artist? Does he carry an extra responsibility for his actions, or do his discoveries stand alone, apart from their possible implications for society?

B. What is the scientist's moral dilemma in the works we are analyzing, and how did it arise? Who suffers--only the scientist, or others? Is there a solution offered in the play? Is it convincing and practical, or only empty hope? Can the solution be carried out by the scientist himself, or does it necessarily involve everyone, as Friedrich Durrenmatt implies in Point 18 of his notes on *The Physicists*: "Each attempt of an individual to resolve for himself what is the concern of everyone is doomed to fail."

C. What is the author's attitude toward the problems of his own play? Does he have sympathy with the hero or protagonist? Is he a moralist, and if so, does the play become pathetic or less forceful as a result? Does the author believe in a solution, or is he writing more out of despair? How does he treat the theme of science in modern life --what kind of a literary form does he employ?

These questions are presented at the beginning of the course to initiate thought and guide the students as they approach each play. As our study progresses, however, other, deeper questions arise, such as the exciting affinity between artist and scientist. Both characters, it turns out, are passionately asking the same vital questions: "How much can I through my experiments [both scientific and literary] learn about the nature of man, and thus about myself? What is reality, and with how much certainty can I describe it? Is the world possessed of an ultimate order which I can help to expose?"

III. SYLLABUS

This is arranged for an academic quarter but can easily be taught over a semester. I also include some central quotes from the plays and a list of additional titles for an expanded course, student reports, or extra reading.

Week 1 Introduction; *Faust* excerpts, "The Sorcerer's Apprentice."

Week 2 G. Buchner, *Woyzeck*. "What is Man? Bones! Dust, sand, dung. What is Nature? Dust, sand, dung." Another Buchner quote, from *Danton's Death*, is valid for *Woyzeck*, too: "What is this in us that lies, whores, steals, and murders?"

Week 3 G. Hauptmann, *Before Dawn*. "I would like to study the conditions of the local miners....In my striving I have assumed something terrible, desolate, and machine-like."

Week 4 G. Haiser, *Gas I* and *II*. "Gas the magician works for you....Tell me, where can I find Man? When will he make his appearance?"

Week 5 B. Brecht, *A Man's a Man*. "Here tonight a man will be dismantled like an automobile without suffering in the least....Modern science has proven that everything is relative."

Week 6 Mid-term; Showing and Discussion of "Knowledge or Certainty," Chapter 11 of Jacob Bronowski's book/TV series *The Ascent of Man*.

Week 7 B. Brecht, *Galileo*. "My intention is not to prove that I was right but to find out whether I was right.... Are we, as scholars, concerned with where the truth might lead us?"

Week 8 M. Frisch, *The Chinese Wall*. "We find ourselves, gentlemen, in the age of the hydrogen bomb, the cobalt bomb....For the first time we face the choice whether mankind will continue to exist or not."

Week 9 H. Kipphardt, *In the Matter of J. Robert Oppenheimer*. "What kind of people are physicists? Can a man be taken apart like a firing mechanism? ....Is there one-hundred percent security?....Can we forbid a government which provides fantastic sums for research to have the results at its disposal?"

Week 10 F. Durrenmatt, *The Physicists*. "Are those murders we committed to stand for nothing? Either they were sacrifical killings, or just plain murders. Either we stay in this madhouse or the world becomes one. Either we wipe ourselves out of the memory of mankind or mankind wipes out itself."

Additional Titles

Jerome Lawrence and Robert E. Lee *Inherit the Wind*	1925 Scopes Monkey Trial.
Peter Barnes *The Ruling Class*	English nobleman believing himself to be Jesus Christ is given shock treatments by German scientist.
Joe Orton *What the Butler Saw*	Bizarre happenings in psychiatric clinic.
Carl Zuckmayer *Cold Light*	Based on Klaus Fuchs story of scientific espionage.
Thornton Wilder *The Skin of our Teeth*	Frisch wrote his *Chinese Wall* as a counterbalance to this play.
Kjeld Abell *Days on a Cloud*	Scientist has second thoughts about atomic research.
Georg Kaiser *The Coral*	First part of *Gas* trilogy.
Bertolt Brecht *The Ocean Flight*	Praise of man's technical prowess.
Bertolt Brecht *Badener Play of Agreement*	Counterbalance to *The Ocean Flight*, urges deemphasis of technical abilities and surrender of individual talents to collective.
Robert Jungk *Brighter Than a Thousand Suns*	Subtitled "The Fate of the Atomic Researchers."
Werner Heisenberg *Physics & Philosophy*	The philosophical implications of modern science.
Jacob Bronowski *The Ascent of Man*	Development of science and its impact on our worldview.

Allen E. Hye
Prof. of Modern Languages
Wright State University
Dayton, Ohio 45431

ON ONE FOOT

Once upon a time an impatient man accosted a sage and asked him to teach him while standing on one foot all of God's scripture. A patient man, the sage accepted the challenge and, standing on one foot, replied: "Do not do unto others what is hateful to you. That is the whole of God's teaching; all the rest is commentary. Now go and study."

During the past six years I have had reason to reflect upon that story many times. Twice a week I lead a rag-tag mob of a hundred engineering students into a confrontation with themselves. I take them to the abyss of their own humanness, to the edge of their bravado, and bid them look down. I joke, I cajole, I entertain; and when they laugh so hard they'll lose their balance, I whirl them around to show them themselves. An impossible task certainly. A job for a fool: to humanize a group that scorns the humanities, while standing on one foot.

Long and often I have pondered their souls: whether it is possible for me or anyone to change attitudes so deep, so old, in such short order. They prefer numbers to people, accuracy to ambiguity, power to compassion. Calling themselves "misunderstood", they cling together, partly out of fear, partly from a need for warmth -- like a band of space-age cavemen, huddled around a fire in the cosmic night.

Again the parable. "What is hateful to you, do not do unto others. All the rest is commentary." And so it is, from 'finite Earth' to 'club of Rome', from 'solar furnace' to 'nuclear boom'. All the slides and all the graphs: just so much commentary on a central truth, an ethical core from which all our separate actions and activities must radiate.

How to make them see that: that is the problem. To make them doubt their own certainty, to make them doubt the sanctity of the corporation god, lord of industry, if only for a moment. To sow the seeds of doubt and of hope. "Now go and study."

It is said (to return to the parable one last time) that as the patient sage was discoursing on one foot, a rival passed and ridiculed his foolish pose.

Steven Bertman, Prof. of Classical
and Modern Languages
University of Windsor
Windsor, Ontario, Canada N9B 3P4

ELEMENTS OF TECHNOLOGY IN A LIBERAL EDUCATION

1980 marks the end of a decade of steadily increasing interest in the interactions among science, technology, and society, an interest that has come to define the STS field. To date, there are over 200 formal academic programs and at least an equal number of informal course clusters serving this area of interest at every level of higher education programming. Concurrently, an increasing number of journals and newsletters, among them this one, have come forth to service these programs, providing an outlet for research activity and information dissemination. In spite of this steady growth, it remains the case that the majority of STS courses are located within liberal arts colleges or in the humanities and social science departments of engineering institutions. While these courses provide valuable humanistic and social science interpretations, both of the roles played by science and technology in shaping contemporary society and of the roles played by social institutions in shaping the directions of scientific research and technological development, very few directly address the issue of technological "literacy". That is, few STS courses seek to present the central elements of engineering; seek to explore in detail the distinction between technology as a social process and the technical problem-solving activity called engineering that is embedded in that process, by starting from an analysis of engineering concepts and engineering techniques. Such an approach is especially important for the non-science/engineering student in today's high-technology society. In this sense, 1980 also marks the opening of a new decade of opportunity for STS curriculum development focused on the elements of engineering.

Lehigh University has developed an extensive STS curriculum during the past decade, but like most other institutions, the majority of our courses are taught by humanities and social science faculty. Although we have long had the intellectual support of our College of Engineering and Physical Sciences, this has normally taken the form of guest lecturing and of service as resource personnel for humanist and social science faculty, rather than full-time teaching of STS courses by engineering faculty. Perceiving this as an increasingly serious gap in our own STS Program, we sought external assistance for the development of a package of new courses that would be taught by senior science and engineering faculty.

In May, the National Science Foundation's Comprehensive Assistance to Undergraduate Science Education (CAUSE) Program awarded Lehigh a $240,000 grant in support of a three-year project to develop six new courses designed with a view to providing students who do not plan on majoring in science or engineering a means of becoming familiar with the basic elements of engineering and of its incorporation into modern high-technology society. A separate "gateway" course, not funded under the CAUSE grant, entitled *Introduction to Technology* is presently being developed by Dr. Adrian Richards (Professor in the Departments of Civil Engineering and Geological Sciences and Co-director of the project). This course will provide liberal arts and business students with an understanding of the unique and complementary elements of engineering without using mathematics. Emphasis will be placed on showing how engineering provides technological solutions to problems in a high-technology society, while at the same time being constrained by societal parameters, e.g., economic, legal-political, or moral constraints. This course is planned to serve as an integrative function for the more specialized courses to be developed with the NSF CAUSE support.

At this point, four of the six faculty for the NSF project have been identified. Dr. Alan W. Pense, Professor of Metallurgy and Materials Engineering, will offer a course entitled *The Regulation of Public Safety*. It will trace the growth of regulation for public safety in three intensively technological industries: boiler and pressure vessel construction, bridge construction, and nuclear power and power plant construction. An engineering background will not be assumed, and the elements of mechanics and strength of materials necessary to understand the nature of the regulations discussed will be an early topic of the course. It is intended that the approach will be sufficiently quantitative that the student can calculate margins of safety and can determine the engineering choices to be made in appropriately simple cases. Such calculations will supplement the conceptual parts of the course and will be designed to show the extent to which quantitative solutions to complex problems can and cannot be used as a subsitute for subjective value judgements.

Dr. Ned Heindel, Professor of Chemistry, will offer *Chemistry for the Consumer*, a course that would treat such socially significant chemical issues as the use of food additives, licensing and manufacture of drugs, plastics, paints, and the chemistry of future energy sources. The topics treated will be used as means to excite student interest in chemical concepts. For example, detergents offer an ideal vehicle for teaching the relationship between chemical structure - bonding type - and chemical properties. In this way chemistry and its laws may be related to important societal problems, "painlessly" instruction the student in both.

A third course, entitled *Urban Design and the Skyscraper*, will be offered by Dr. Lynn Beedle, Professor of Civil Engineering. The objective of the course will be to present the parameters that affect the decision making, the planning, the design, the construction, and the operation of tall buildings, considered as systems that bring together many disciplines within and outside of engineering. The course will present to the students the primary professional tools available to, and commonly used by, the various engineering specialties involved in tall building design within the total urban context.

Dr. William E. Schiesser, Professor of Chemical Engineering, will offer the fourth course, *Modeling and Simulation of Socio-Economic Technological Systems Using Computers*. The course will have as its principal objectives an introduction to: (1) the formulation of mathematical models for complex socio-economic-technological (SET) systems; (2) the details of programming of SET models in a standard computer language; and (3) the execution of the model programs to gain insight into the behavior of the SET systems. An emphasis on both quantitative modeling and underlying qualitative judgements will be facilitated by concentrating on problem areas which are currently of major interest and will probably remain important throughout the working careers of present day students, e.g., energy, pollution, natural resource depletion.

Proposals for two additional courses are currently being sought from Lehigh faculty. Although no final decision has yet been made, plausible topics include industrial robots, space engineering, energy technology, and medical research. The package of new courses will be integrated into Lehigh's Science, Technology and Society Program whose Director, Dr. Steven L. Goldman, is Project Director for the grant.

This set of seven courses, one general and six specific, will offer students, especially those not planning to major in science or engineering fields, an opportunity to acquire an understanding of the fundamental elements of engineering. At the same time, those science and engineering students who take the courses will benefit from a clearer understanding of the social context of their disciplines. The challenge as well as the excitement of the project lies in the necessity of developing courses which teach substantive technical concepts in a qualitative manner so that they are understandable to the non-quantitatively-oriented liberal arts student.

In conjunction with the course development phase of the project, Lehigh will sponsor a national conference on the fundamental elements of engineering and how they might best be taught to non-science majors in a qualitative manner. The director of this conference will be Dr. Richards. It is hoped that the papers presented at this conference would define a suitable text for the introductory course currently being developed. At the close of the three year grant period, Lehigh will hold a second conference for the purpose of disseminating to other academic institutions the results of the overall project.

Further information about the CAUSE project, the conferences, or the STS Program can be obtained by writing to: STS Office, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015 or by calling (215)-861-3350. *S.H.C., editor.*

TRANSPORTATION AND THE CITY

Howard L. Preston, *Automobile Age Atlanta: The Making of a Southern Metropolis.* Athens, Georgia: University of Georgia Press, 1979. xix, 201 p. Illus., maps, tables, $15.00

Carl W. Condit, *The Port of New York: A History of the Rail and Terminal System from the Beginnings to Pennsylvania Station.* Chicago: University of Chicago Press, 1980. xvii, 456 p. Illus., maps, tables, $29.00.

Both of these authors would readily agree on the importance of transportation in determining the form and much of the quality of urban life. Both recognize that changes in the prevailing type and efficiency of the intra- and inter-urban transportation systems have had a profound effect on cities during different time periods. From that starting point, however, they go off in strikingly different directions. Howard Preston, in examining early twentieth century Atlanta, takes the technology as a given. There is no mention of improvements in the speed, reliability, and convenience of the automobile; the methods of its manufacture which greatly reduced its costs; or advances in road building and paving. The book focuses on evaluating the impact of the car on the form and structure of the city. Carl Condit, on the other hand, concentrates primarily on changes in the technology of rail transportation and related technologies in bridge and tunnel building. Condit points out the importance of these technologies in improving the efficiency of freight and passenger traffic around New York harbor, but the emphasis is distinctly on the technology itself.

Preston argues that urban historians have neglected southern and western cities which became major metropolitan centers in recent decades. In such communities the horsecar and trolley exerted less influence than they did in cities of the northeast and mid-west. He offers Atlanta as a case study to rectify this imbalance. At the turn of the century Atlanta was still a relatively small city of 90,000. A key event stimulating Atlanta's development and promoting car ownership was the 1909 National Automobile Show hosted by the city. It was the first time the annual show was held anywhere besides New York or Philadelphia. The auto show provided the city with publicity and visibility which helped to make it the leading regional center of the southeast for the automobile industry.

Automobile ownership in Atlanta jumped dramatically in the following decade. By the 1920s Atlanta suburban developers ceased to be concerned whether public transportation was available for perspective residents. Streetcar ridership fell sharply, as it did elsewhere, and traffic congestion in the central business district became a serious problem. The business district underwent considerable change as many general kinds of land uses, such as grocery stores and gas stations, shifted outward and high-value specialized functions appeared. There are several valuable maps plotting the movement of specific lines of business.

In the process of outward expansion the city also reinforced and increased its racial segregation. The main axis of fashionable development in Atlanta was northward. A combination of deed restrictions and zoning laws completely excluded blacks from that entire quadrant of the city. There were some poorer immitations of suburban development for blacks on the west side. The discussion on the black suburbs, unfortunately, lacks the detail and sense of concreteness of the white suburbs. Preston makes the point that Atlanta blacks lived in new homes instead of the hand-me-down flats and tenements of the north. But, there are no pictures of these homes and the significance of these differences for the quality of life is not demonstrated. On the whole this is a useful case study of the impact of the automobile in one city. There are some excellent maps and illustrations. Aside from the inattention to technology, the book in some places is rather general; a slightly longer study might have been more valuable.

In Carl Condit's estimation, the four greatest works of building art in America are: the Brooklyn Bridge, the Grand Central and Pennsylvania Railroad Stations, and the New York subway system. Of these four, he holds Penn Station, together with its tunnels, bridges, yards, and electrification apparatus to be the premier building project in the country's history.

The water system which helped make New York harbor the world's largest and busiest port also impeded the movement of passengers and freight around the metropolis. By the late nineteenth century, twenty major rail lines descended on the narrow penninsula of Jersey City and Hoboken while only three lines entered Manhattan. Despite extensive enlargement of the New Jersey facilities, the building of Grand Central Depot, and the improvement of the Long Island railroad, the immense congestion remained. The harbor was a tangle of car floats, ferries, lighters, and ocean-going vessels. The problems of the large and rapidly growing metropolis required solutions on heroic scale which imaginatively utilized the latest technologies.

Condit demonstrates how new technological breakthroughs in the late '80s and the '90s came together at the outset of the new century to create a viable solution on a scale commensurate with the vast metropolis which was emerging, and to establish an integrated rail network for the port which linked Manhattan with the rail lines of the northeast. The technologies were in tunneling, bridging, interlocking automatic electric switching, railroad electrification, and steel framing. All of these techniques were utilized on a vast scale for the Pennsylvania Station project.

Between 1900 and 1916 the Pennsylvania Railroad, using its own resources, built a rail line from Newark across the meadowlands, dug a tunnel under the Bergen Hills and the Hudson River to 34th Street and Seventh Avenue in New York, erected there an architectural and engineering masterpiece in Pennsylvania Station, continued its tunnel across Manhattan and then carried its tracks over the swirling and dangerous waters of the East River on the Hell Gate Bridge to the extensive yards of the Long Island Railroad. Condit details the plans and execution of this entire project together with the electrification of the lines which was necessary to carry the trains through the long tunnels.

Some readers may see limitations to the study, but this depends on the reader's perspective and background. In places technologies are discussed, but their significance is not explained, as in the case of the locomotive types used on the major railroads. On the other hand, when Condit discusses the development of automatic interlocking switching devices for the rail yards and the methods for electrifying the railroads, the advantages of different techniques are explained in detail. Condit relates the evolution of the transportation network to the growth of Manhattan and the port region, and places the building of the rail stations in the context of the great monuments of civic architecture of the era, but the richness of detail is clearly reserved for the technology itself.

Professors teaching courses in the history of technology, technology and society, and urban history will find much of value in both of these volumes. In paperback, Preston would make suitable reading for undergraduate courses, particularly for any course centered around the role of the automobile. Condit's work provides a good source of lecture material for a variety of courses. As with his other work, he shows the impact of technology, particularly electricity, on the changing structure and form of the city. Condit's main contribution is to demonstrate the convergence of a number of major technological breakthroughs in solving the transportation problems of the country's largest port.

Roger Simon
Assoc. Prof. of History
Lehigh University
Bethlehem, PA 18015

THE POWER TO CHANGE

An Audio-Visual Review

Appropriate technology (AT) is fast becoming a practical alternative to today's often centralized, bureaucratic, and highly energy-consumptive society. "The Power to Change" provides a convenient twenty-eight minute introduction to AT in the United States in a 16mm color film format. The movie subtly introduces the viewer to the basic concepts through a series of mini-sketches of AT projects. These segments are linked together by Joanne Woodward's narrative and brief clips of observations by George McRobie, Chairman of the Intermediate Technology Group (London), which are interspersed through the film.

All over the country small family-size farms are rapidly disappearing, economic victims of large-scale, agribusiness farming, typified in the film's early footage by a mechanical tomato picker. The Vine Street Food Fair in Nashville, Tenneseee, is offered as an alternative. Food Fair is part of a southeast regional Agricultural Marketing Project in which farmers sell their produce directly to the consumer in a neighborhood market setting, thereby eliminating middlemen costs for both producer and consumer and offering some reasonable hope for the smaller farmer.

Shifting from rural to urban America, a second segment of the film emphasizes local self-reliance in a city setting through a depiction of the Bronx Frontier Development Corporation which operates a large-scale composting operation and open-space greening project. Scenes of gardens and playgrounds in a revitalized neighborhood show what can be done with a minimum of otherwise waste-resources when people are willing to expend the necessary effort. The sense of community spirit displayed in the urban Bronx project is also the theme of a planned, suburban solar community in Davis, California. Here the emphasis is on energy conservation (50 - 80% of the community's space-heating and cooling needs are provided by solar) combined with the humanistic values inherent in cooperative gardening, recreation, and transportation.

Whether appropriate technology can be profitable is answered in the affirmative by the experience of Encore, a San Francisco-based, bottle recycling company. Encore collects, washes, sorts, and sells "revitalized" bottles back to local wineries --all at a profit-- in a project particularly appropriate to California. Whether the opportunity to engage in AT on a practical business level will spread will depend on increased public awareness and acceptance, such that significant markets for AT products will develop enabling small businesses to compete successfully with larger corporations. This theme is developed by the president of Aero Power systems, a small producer of wind-powered electric generators.

The importance of solar energy is one of the major arguments in the AT promotor's intellectual arsenal. To support this view, three successful applications by Nebraska farmers for grain drying, barn heating, and a greenhouse that also serves as an additional source of home space heating are briefly depicted. Here the theme is technological ingenuity in contrast to complexity, although clearly technical sophistication may well be necessary in AT developments. An example of such a situation is provided by the development of the Windmobile, a very sophisticated electric automobile making use of aeronautical engineering design and building techniques.

A modern-day analog of the traditional New England barn raising closes out the film when a group of Cape Codders build and triumphantly raise a 4000 watt wind generator. In the final frames, the owner (and presumably the audience) basks in the warm glow of the electric light generated by this newly-erected windmill.

Despite this positive ending, there remain for me several limitations to the film. "The Power to Change" clearly shows what can be done with AT; however, the social, political, and economic choices and decisions which must precede and accompany the technical developments will ultimately be more important and more difficult. In discussing these points the film is less explicit, although still adequate, than it might be, leaving much analysis to the audience to be aided only by a brief list of discussion questions and projects in an accompanying study guide.

There are two other areas in which the film is less informative than one might expect. Unless the viewer is extremely familiar with the background and principles of AT --the conservation of resources, self-reliance and independence, gentleness to the ecosystem, low-cost, labor intensiveness, decentralization, small-scale, durability, and creativity-- he or she may have to struggle a little to see the whole picture, for the film does not clearly state these ideas up front. Rather they are more subtly brought out by the different film segments. In classroom use, a good instructor might find this to be of little consequence by adequately preparing the audience, perhaps even choosing to take advantage of the vagueness as a way to bring out and drive home each of the points. Here the study guide is also useful in providing a brief outline of AT's principle characteristics.

A more important consideration is the failure to discuss AT in the context of developing nations. It is here that the movement gained much of its original impetus and will have much of its future impact. Thus, it seems strange that this is not really discussed. Except for several brief appearances by George McRobie, a casual uninformed student could come away from the film thinking that AT was a movement invented by and only applicable in the highly industrialized United States. Although the producers clearly intended only to focus on the U.S. experience, it would still appear to be an important oversight. We are already too insular in this country, and there is no need to compound the problem. The AT movement is much broader. Here again, despite the omission, a good classroom instructor should be able to agument the film on this point.

I raise these points only to suggest that a certain modicum of caution and extra preparation will be necessary in using the film with some audiences, for what will be obvious to one group may not be to another. Otherwise the film is well-paced and provides a very human look at what is coming to be a very viable alternative to a large-scale, wasteful mass-society (it might even be its salvation) as well as a goal for developing nations.

"The Power to Change" is available from Third Eye Films, 12 Arrow Street, Cambridge, MA 02138 (617-354-1500) for purchase at $425 or rental at $40, which may be applied toward the purchase price. In either case there is a $5.00 handling fee. A short guide accompanies the film and includes study questions and suggested activities as noted, as well as a brief bibliography of standard AT sources, periodicals, and organizations. It also contains a brief summary of the film and description of each of the featured groups. Taken as a whole, the movie is well worth considering for use in the classroom or for community and service groups.

SHC, Editor

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International Engineering Ethics Project

Ethical dilemmas facing engineers practicing in a culture other than their own is the topic of a current research project. The study will identify and collect information concerning ethical conflicts that can arise in all areas of engineering work --design, implementation, management and interaction with local personnel and institutions.

Individuals who can contribute to this study are asked to contact either of the Co-Directors: Professor E. C. Jones, Dept. of Electrical Engineering, Iowa State University, Ames, Iowa 50011; or Professor C. A. Smith, Dept. of Philosophy, University of Missouri-Rolla, Rolla, Missouri 65401. All information received will be treated confidentially.

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BARBOUR, IAN G. TECHNOLOGY, ENVIRONMENT AND HUMAN VALUES. NEW YORK: PRAEGER PUBLISHERS, 1980. 331P.

The 1980s will see tradeoffs among goals for environmental preservation, economic growth, jobs, and health. Making these choices involves selecting among conflicting values. Barbour identifies and surveys three pertinent values groups: human needs (e.g. survival, health); social values (e.g. justice, freedom); environmental values (resource sustainability, ecosystem integrity.) For each group, philosophical discussion provides the backdrop for an examination of issues ranging among duties to nonhumans, the worth of cost-benefit analysis, limits to growth, and alternative technology. The book ends on a hopeful biblical note, calling for a new image of human fulfillment based on nonmaterial sources of satisfaction.

BRIGGS, ASA. IRON BRIDGE TO CRYSTAL PALACE; IMPACT AND IMAGES OF THE INDUSTRIAL REVOLUTION. LONDON: THAMES AND HUDSON, 1979. 208P. ILLUS., BIBLIOG. $16.95.

Through collaboration with the Ironbridge Gorge Museum Trust, techniques of industrial archaeology are drawn upon to examine and interpret the early era of the Industrial Revolution beginning with the building of the Iron Bridge spanning the River Severn in 1779 and ending with the Crystal Palace Exhibition of 1851. Concerned with the understanding of images as well as things, Briggs organizes his study into considerations of places, people, processes, and products. Centering on the area of Coalbrookdale and ranging to other industrial centers in Britain, a careful study of "stones and mortar" becomes a social history of a way of life. The author's fine understanding of the technical and artistic literature of the period is augmented by extensive use of illustrative material, including maps, engineering and scientific drawings, paintings and engravings, and photographs. A superb work of retrospective technology assessment, the study embraces the environmental and social impacts of industrialization, its effects on daily life, and the artistic response.

BROWN, D. CLAYTON. ELECTRICITY FOR RURAL AMERICA: THE FIGHT FOR THE REA. WESTPORT, CONN.: GREENWOOD PRESS, 1980. 224P. BIBLIOG. $22.50.

The genesis of the Rural Electrification Administration and its long-fought battle to extend electricity to farms in America are traced. The opposition to the development of public utilities and the resistance of power companies to serve the rural population were not the only barriers to extension of facilities. Brown also chronicles the organizational problems and the establishment of policy within the REA. It was not until after World War II that electricity was generally available to rural areas especially in the South Central region. The changes from a preindustrial existence in labor, social relations, and lifestyle brought about by the benefits of electrical technology are also given attention.

CANTORE, ENRICO. SCIENTIFIC MAN: THE HUMANISTIC SIGNIFICANCE OF SCIENCE. NEW YORK: ISH PUBLICATIONS, 1977. 487P. $20.00.

A Jesuit and Director of the Institute for Scientific Humanism, Cantore considers science a fundamental activity of man, an essential factor in his history, and necessary to his self-fulfillment. At the same time, he believes that science alone cannot explain man's place in the universe. The scientific process and its meaning for humanists is explored at length, with liberal use of evidence provided by quotations from working scientists through the centuries. Calling for a new synthesis of the knowledge of science with the reflection of philosophy, Cantore concludes that "science is humanistic only to the extent that man develops the potentialities of the spirit that gave rise to science itself and keeps it thriving today."

FRIEDLAND, WILLIAM H.; BARTON, AMY E.; THOMAS, ROBERT J. MANUFACTURING GREEN GOLD: THE CONDITIONS AND SOCIAL CONSEQUENCES OF LETTUCE HARVEST MECHANIZATION. UNIVERSITY OF CALIFORNIA, DAVIS, JULY 1978. 157P.

The term "mechanization of agriculture" does not take into account the peculiarities in growth or handling of individual crops that may impede or encourage mechanization. Mechanical means for harvesting lettuce are presently available, but have not been widely adopted. The authors' analysis reveals that an important necessary condition-adequate handling methods - has not yet been achieved. Among projected social consequences of mechanization are fewer seasonal workers and a concentration among grower-shippers.

HARDIN, GARRETT. PROMETHEAN ETHICS: LIVING WITH DEATH, COMPETITION AND TRIAGE. SEATTLE AND LONDON: UNIVERSITY OF WASHINGTON PRESS, 1980. 82P. $7.95.

As in earlier writings, Hardin argues for the social necessity of such unpleasantries as abortion, triage, and death to counter explosive population growth. His "Promethean ethics" stresses quality over quantity of life: "The task of Prometheus is to know vicariously ahead of time what is too much of a good thing so that we do not make the mistake of striving for the bad of too much good." The widespread belief that man has a "right to breed" and also to eat is in Hardin's view a formula for war, a "tragedy of incompatible rights." Competition for scarce resources is inevitable. To guide allocation, Hardin suggests the adoption of "triage," a system originally devised to classify war wounded when need surpassed available help. Applied to the world situation, a triage policy would direct aid to the salvageable needy, but not to the relatively well off or the hopeless. Mathematical support for the life-saving superiority of a "triage" over a "parity" policy is presented.

JOHNSTON, RON AND GUMMETT, PHILIP, EDS. DIRECTING TECHNOLOGY. NEW YORK: ST. MARTIN'S PRESS, 1979. 271P. $22.50.

The directing of technology has two facets --promoting and controlling-- both addressed by this collection of thirteen original studies. Keith Pavitt looks at government support of industrial technology in Western Europe; Ian Chapman contrasts the Canadian experience. Roger Williams suggests that nuclear power has been treated as a "special case" of technological development marked by a high degree of political control. Government involvement in contracting, and in the aerospace and motor industries are discussed in subsequent papers. Among articles treating "control" are a survey of the realm of regulatory agencies by Judith Reppy and a review of the growth of environmental controls over the past two decades written by Dave Eva and Harry Rothman. Case studies address recombinant DNA and pesticides and examine technology assessment and international parliamentary policies. Geoffrey Price's summary chapter "Political Frameworks for the Control of Technology" concludes the volume.

LADENSON, ROBERT F.; CHOROMOKOS, JAMES; D'ANJOU, ERNEST; PIMSLER, MARTIN; ROSEN, HOWARD, COMPILERS. A SELECTED ANNOTATED BIBLIOGRAPHY OF PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY IN ENGINEERING. CHICAGO, ILL.: CENTER FOR THE STUDY OF ETHICS IN THE PROFESSIONS, ILLINOIS INSTITUTE OF TECHNOLOGY, 1980. 157P. Available on request (no charge).

An unusually thorough and well-organized annotated bibliography. The introduction provides a thoughtful overview of the literature of engineering ethics, distinguishing between traditional literature, the ethical scope of which is generally limited to codes, bribes, and competitiveness and more recent papers reflecting broader concern with social responsibility. The first sections of the bibliography (Pt. I, Professional Ethics; Pt. II, Social Responsibility) reflect this division. Pt. III moves to "General Issues" encompassing works in ethics and historical and philosophical studies of engineering. An appendix offers brief reading lists on technology, society, and culture.

MILLER, JON D.; ROBERT W. SUCHNER; ALAN M. VOELKER. CITIZENSHIP IN AN AGE OF SCIENCE. NEW YORK: PERGAMON PRESS, 1980. 382P. BIBLIOG. $25.00.

Utilizing a testing instrument titled the 1978 National Public Affairs Study, the authors present an analysis of public attitudes toward science and technology, with an emphasis on the "preadult" group. Social factors which tend to determine attentiveness in these areas are identified. Also considered are the evolution and effects of organized science, the development of issue-related attention, and the implications of public interest for policy development. The testing instrument is included in an appendix. Pedestrian presentation.

PETULLA, JOSEPH M. AMERICAN ENVIRONMENTALISM: VALUES, TACTICS, PRIORITIES. COLLEGE STATION AND LONDON: TEXAS A&M UNVERSITY PRESS, 1980. XIV, 239P. $18.50.

Petulla identifies three currents of an American environmental tradition: the biocentric (nature as "mana," worthy in itself), the ecologic (balance in nature benefits man), and economic (wise use of resources assures a better future). The histories of these three forms of environmentalism are followed, with major proponents, cases, and issues profiled. Petulla provides a highly readable overview of the ideas of writers including Emerson, Thoreau, Leopold, Ehrlich, Carson, Commoner, and Hardin. He traces the evolution of wilderness legislation, explains the principles behind environmental cost-benefit analysis, and documents the effects of regulations. Noting mounting pressures from industry to relax clean air and water standards, the author calls for a democratization of traditionally elitist environmentalism as part of the forging of a new environmental ethic linking social justice and the environment.

PORTELLI, ALESSANDRO. "THE THREE LAWS OF ROBOTICS." SCIENCE-FICTION STUDIES 7 (JULY 1980): 124-34.

Throughout his career, Isaac Asimov has attempted to revise the image of the robot from a dangerous and disloyal creation to an obedient, placid guardian governed by the "three laws of robotics." Though Asimov perhaps intended the laws to remediate the anti-scientific bias of science fiction, Portelli suggests that the "laws" function in other, probably unintended ways. In that possible relations between humans and robots are predetermined, the laws "draw the boundaries of possible plots." In creating a permanent robot "underclass," Asimov has assured that the issue of racial conflict, as well as more obviously machine-related themes as automation and impersonal mechanization, must resurface again and again in his works. Portelli's essentially Marxist analysis concludes not unpredictably: "Perhaps the idea which Asimov fears and negates . . . is that the monstrous, uncontrollable machine which contains the labor force, the means of production, the commodities is neither the robot nor the automobile but capitalism itself."

ROSSITER, MARGARET W. "WOMEN'S WORK IN SCIENCE, 1880-1910." ISIS 71 (SEPTEMBER 1980): 381-98.

The 1880s and 1890s witnessed great expansion in the American scientific labor market. At the same time, the enrollment of women in colleges was on the rise. Though it was originally believed that women could (and should) function only as amateurs in science, economic and labor exigencies encouraged their employment. It was astronomy, Rossiter notes, that women first entered in significant numbers, classifying photographs of stellar spectra, doing tedious computations, receiving few advancements and rarer raises in spite of some important contributions. Concurrently, the federal government furnished some jobs in the fields of botany and anthropology. As land grant colleges grew, they promised another outlet for talented women scientists; however, the latter were soon shunted off into home economics and hygiene. Rossiter concludes that the creation of cadres of scientific "assistants" and of feminized scientific curricula "offered a harmonious way to incorporate the newcomers into the scientific labor force" that kept women scientists divided and anonymous.

STAPLETON, DARWIN H., ED. THE ENGINEERING PAPERS OF BENJAMIN HENRY LATROBE. THE PAPERS OF BENJAMIN HENRY LATROBE, SERIES II, VOLUME I. THE MARYLAND HISTORICAL SOCIETY. NEW HAVEN, CONN.: YALE UNIVERSITY PRESS, 1980. XX, 256P. ILLUS., MAPS, BIBLIOG. $82.50.

Benjamin Henry Latrobe was an important early American architect and engineer. This volume, which is part of the larger Latrobe Papers project, brings together slightly over half of Latrobe's engineering drawings. (His architectural drawings are collected in another volume in the series.) Darwin Stapleton's excellent introductory sketch of Latrobe's engineering career provides important insights into the ways in which technology was transferred and developed in early America. He has also provided careful annotations of the eighty-four drawings included in the volume. Most of the drawings deal with Latrobe's transportation projects, the Philadelphia Waterworks, and the Washington Navy Yard steam engine. There is also a special section pertaining to Latrobe's Susquehanna River survey map in which Stephen F. Lintner, a river systems specialist, analyzes the original 17' map and Latrobe's technique in producing it. An appendix listing the remaining thirty-two known Latrobe drawings and two brief bibliographies round out the volume. This important scholarly volume provides valuable "non-verbal" insights to the working career of an early engineer through the visual record of his drawings. Highly recommended. SHC

TECHNOLOGY AND ITS IMPACT ON SOCIETY: SYMPOSIUM NO. 1, 1977. EDITED BY SIGVARD STRANDH. STOCKHOLM: TEKNISKA MUSEET, 1979. 280P. ILLUS., BIBLIOGS.

Studies in the history of technology are presented as the base from which to achieve a broader knowledge of technology's role in culture. This fine collection ranges from considerations of iron metallurgy in prehistoric society, scientific instruments of the Medici, the introduction of the steam engine to Dannemora Mines, to the origins of centrifugal separation technology, the relationship between technological progress and professional mobility, and regional technological style. European authors are joined by Americans Brooke Hindle, Thomas Hughes, Melvin Kranzberg, and Eugene Ferguson. The latter three authors relate historical investigation to contemporary technology assessment.

"TECHNOLOGY AND PESSIMISM." SPECIAL ISSUE. ALTERNATIVE FUTURES 3 (SPRING 1980): 3-155.

The first issue of this journal devoted to a single topic. Melvin Kranzberg's opening paper is the most optimistic of the collection. Despite its detriments, he argues, only through technology can the basics of life be provided for an expanding world population. Samuel Florman, describing the history of American technology as a tale of catastrophe as well as triumph, urges adoption of a "tragic view." While we "press ahead in the name of human adventure," we must shoulder and share culpability for what goes awry. John Broomfield, responding to Kranzberg and Florman, charges that the scale of modern technology has made it a fearful "adventure." In the next paper, Leo Marx describes the pastoral and progressive views held simultaneously in industrializing America. Richard Falk's article suggests that no governmental unit is now emerging to cope with technology and the threat of war. While increasingly interdependent, the globe is fragmented by intensified statism. In literature, optimistic responses to technology are rare, Sverre Lyngstad reports. A Soviet post-Revolutionary cult of technology produced dull novels "fit to be read by machines," but prevalent metaphors have depicted the machine as an infernal false god or uncontrollable monster. Eugene Goodheart registers the romantic objection to any sort of inorganic, inhuman, imbalanced production mode. In his summary paper, Howard P. Segal comments on the complexity of American stances toward technology, particularly as represented in the works and writings of industrial designers, reformers, and "literary engineers."

"TOMORROWS HOMO FABER; INTERACTIONS BETWEEN MAN AND HIS TOOLS." ISSUE TITLE. IMPACT OF SCIENCE ON SOCIETY 30 (APRIL-JUNE 1980): 79-158.

Several philosophers, a systems scientist, a medical researcher, an aeronautical engineer, a biologist, a philosopher, an industrial designer, and a science journalist examine the relationship between tool-using man ("homo faber" or "homo habilis") and "man-using" tools. Authors including K.K. Murthy, Reginald Foldy, Jennosuke Kishida and Nuri Belgin discuss values changes that might help us avert a "Faustian bargain of suicidal potential." Tom Mikkelsen, and V.P. Zinchenko and V.M. Munipov present a portrait of future scientific man. Remaining papers study the place of education and advances in health care.

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Science, Technology and Society Program
327 Maginnes Hall #9
Lehigh University
Bethlehem, PA 18015

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THE ENGINEER'S ROLE IN TECHNOLOGICAL GROWTH

Because of the primary role that engineers have played in the growth of technology, they are often considered to be the evil force of technological growth. But are engineers the force responsible for the evil side of technology? A solid case can be made that the responsibility must be shared by many elements of society, including scientists and engineers, courts and judges, politicians and governmental institutions, economists and managers and, not least of all, the public. For those who are dissatisfied with the results of technological growth, it is foolish to blame some impersonal, uncontrollable force called technology rather than the values and social structure that are responsible for the past allocation of both human and material resources.[1] Because knowledge is a public good, the public has an ethical responsibility to be as knowledgeable as possible and to make its views known to the legislators. After all, it is the legislators who control the allocation of a significant portion of the resources that are used to support technological growth, and in the past much of our resources have been allocated for research and development within the military-space complex. It is public policy and societal values that set trends in technological advancement, not the engineer.

Public policies that allocate a portion of the research and development monies for technological assessment, and not just for technological growth, must be established. The economist certainly has a responsibility in determining just what portion should be allocated to technological assessment. But the responsibility of the economist is even greater because there is a social value of a resource. The economist must assess the components that influence the social value of a resource and develop a system that will provide a basis for technologists to assess just how far technology should be advanced. The value system developed by the economist must reflect both the social value and the value of its current demand. The manager working closely with the economist must provide the formula for allocating resources between current use and future use. Certainly, the manager's formula will reflect the economist's value system which, hopefully, will reflect society's value system.

Bazelon[2] outlined the responsibilities of the court in solving societal problems that involve risk. The courts must foster the kind of dialogue and reflection that will improve the quality of decisions, whether they are made either by politicians or by economists, engineers, and scientists. From engineers and scientists the courts can request the theoretical and empirical basis for decisions. Even more important, the courts must identify the reasoning used in determining the level of risk that is considered acceptable. From economists, the courts must determine the weights in the value function that were assigned to technological and social values as well as the way in which the effect of uncertainty in each was assessed. The courts must finally weigh the risks and responsibilities, with the knowledge that risk regulation is itself a risk.

The engineer plays a central role in both technological advancement and technology assessment. Certainly, they must provide both the public and the legislators with the knowledge from which rational decisions and risk assessments can be made. In order to do this, the engineer has a moral responsibility to maintain competency through continued professional growth. This is part of the motivation for professional codes of ethics. The engineer is often criticized for not recognizing and accepting the role that politicians and courts must play in technology; just as these other forces have responsibilities in shaping technological growth, the engineer has an obligation to become sufficiently knowledgeable about the responsibilities of others so that the interested parties strike the optimum level of balance in controlling and shaping technological growth. And, certainly, the engineer has the responsibility to formulate and test the hypotheses that will advance the state-of-the-art.

If it is reasonable to state that the engineer is not responsible for determing the acceptable risk level, then who is responsible? The responsible individual, group, or institution depends on who is affected by the risk, including future generations. Where governmental policies and funds are involved, the responsibility must be borne by those establishing the policy and dispensing the funds, which is usually those in the executive and legislative branches of government. In nongovernmental cases, the affected public must bear the responsibility. In either case, it is necessary for the responsible party to be knowledgeable about the risks, very often through interaction with the engineer.

Of specific concern here is the role and responsibility of the engineer. Through education and experience, individuals in the engineering profession develop special knowledge and skill. Therefore, they have a special role in technological growth, and also in technological assessment. With respect to risk, it is important for engineers to identify risks associated with technological changes and to educate the public about these risks. Furthermore, the engineer must recognize the interaction between technology and social values.

Because the interaction between technology and social values is important, engineering educators and accreditation institutions should stress the important role of courses in the humanities and social sciences as a part of engineering education. Too often, engineering students are permitted to fulfill course requirements for humanities and social sciences with courses in which the material is totally insensitive to the importance of the interaction between technology and social values. The education programs would be improved if humanities and social science courses were evaluated with respect to their sensitivity to this interaction and requirements established to ensure that students were exposed sufficiently to the appropriate matter. There appear to be at least two roadblocks to achieving this objective. First, the engineering educator often has little power in directing the development of requirements in the humanities and social sciences; very often these requirements are established by those "across campus". Second, many engineering educators have little interest in the nontechnical electives and fail to provide the proper guidance to engineering students in the selection of humanities and social science courses that are sensitive to social value issues. Hopefully these roadblocks will be lifted as the road to higher education becomes better paved.

Richard H. McCuen
College of Engineering
University of Maryland
College Park, MD 20742

Science, Technology & Society is a newsletter devoted to material in the general area of science, technology, and human values. We publish short articles on the theoretical and speculative aspects of curriculum development, in-depth course descriptions, reviews of texts and audio-visual aids, and current bibliography (annotated). In addition, we welcome articles on successful techniques for such tasks as instituting and evaluating a course or program, arousing faculty and student interest, obtaining visibility on campus, running a lecture or film series, or editing a newsletter. An "Open Forum" section exists for readers with questions or comments regarding any curriculum need. Our goal is to help generate new courses and to provide an information exchange in the STS field.

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1. Rosenberg, N., "Technology, Economy, and Values," pp 81-111 in *The History of Philosophy of Technology*, Bugliarello, G., and D.B. Doner, eds., University of Illinois Press, Urbana, 1979.

2. Bazelon, D.L., "Risk and Responsibility," in *Science*, 205 (July 20, 1979): 277-280.

COURSE SYLLABUS

POLITICS AND THE TWENTY-FIRST CENTURY

PLS 382

Benjamin Hourani
Dept. of Political Science
Eastern Michigan University
Ypsilanti, Michigan 48197

Course Description:

This course deals with politics and policy directions of the modern polity in an age of accelerated change. It is an attempt to understand the interactions of (1) Science-technology; (2) Social structures/political structures; (3) Culture as value systems; and (4) factors or events. Such an understanding requires a theory of change. A definitive theory of change is not available. However tentative hypotheses about the interplay of the above factors are present in the research and writings of modern social scientists.

The *focus* of the course is:

1. on the scientific and technological revolution and the transition from industrialism to post-industrialism, and
2. on the political consequences of scientific and technological change on policy options.

Objectives:

Students will:

- become acquainted with the dynamic factors transforming the politics of our world;
- develop an awareness of the meanings of change and its impacts;
- experience a raised consciousness of probable political futures as a first step toward directing change;
- assess current prognostications and their implications for the world they live in;
- enhance their scholarly concern with forecasting for policy making and action;
- be challenged to engage in generating alternative political theory development suited to life in new and unprecedented circumstances.

Politics and the Twenty-First Century will be conducted through lectures, readings, discussion, and when possible with the aid of films and resource persons. The objectives of this course will be best served by the willingness to learn on our own; sharing insights in the class discussions; and the development of creative images of our own and society's future, and determination to gain increased knowledge of analytical skills for macro-analysis of multivariate factors - essential for social forecasting. Students are asked to cooperate in the following activities that determine the grade:

1. Develop a personal file of reaction papers - of topics discussed or to be discussed, assigned, or contributed to class with the intention of enriching the discussion and your personal growth.

2. Perform well on an open notes exam consisting of a selected package of questions to be delivered to you early in the semester and answered in a class period. Your personal file and other notes can be used to help write up your answers in class.

3. Term paper - designed to be a possible chapter in a book on the politics and the twenty-first centery. The table of contents of the book will be consenually determined or mandated by Hourani.

Assigned and Recommended Readings:

Textbooks: Boulding, K., *The Meaning of the 20th Century* (1964).
Brzezinski, Z., *Between Two Ages* (1970).
Dickson, P., *The Future File* (1977).
Harman, W. W., *An Incomplete Guide to the Future* (1976).
Meadows, D. H., et. al., *The Limits to Growth* (1972).

Readings: Assigned and Recommended -

January 8 Introduction: The crisis of Transformation and the Search for Directions.

January 10 Global Overview of Politics, Political Systems and Crises.
* Politics and Me: Does Politics Matter?

January 15 Problematics of "Progress" and Exponential Growth.

Read: John Platt, "What We Must Do," *Science*, 166:1115-1121 (1969); and Meadows, *Limits to Growth*, "Introduction" plus chapter 1.

Recommended: T. J. Gordon, "Some Crises That Will Determine The World of 1994," *Futurist* (June 1974): 115-121.

* Progress: Myth or Reality?

January 17 Future Perspective: An Aid to Political Theory Building.

Read: Fred L. Polak, "Responsibility for the Future," *Humanist* (Nov/Dec. 1973); Paul Dickson, *Future File*, chapters 1 and 2.

Recommended: Wendell Bell, "Social Science: The Future As a Missing Variable," in Toffler, Alvin, *Learning for Tomorrow* (Random House, 1974): 75-102.

* Mankind is Passing from the Primacy of the Past to the Primacy of Expectations of Vast Future Changes.

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* Subjects for student reaction papers - each is one typed page.

January 22 Towards a Theory of Change: Determinants of Change.

Lecture: Framework for Analysis

- "It is not the consciousness of men that determines their being, but on the contrary, their social being that determines their consciousness."

January 24 Student-Teacher Conference.

January 29 Prognosticators: Assumption and World Views: Optimists and Pessimists.

Read: Dickson, *Future File*, chapter 3; Interview with Herman Kahn in the *Humanist* (Nov/Dec., 1973); Jib Fowles, "Humanity and Its Gloom-Doom Prophets," *Futurist* (June 1974): 135-36. See also F.S. Hopkins "Prometheans and Epimetheans," *Futurist* (June 1974): 131-134.

- I am a(n) pessimist/optimist because . . . .

Recommended: Heilbroner, Robert L., *An Inquiry into the Human Prospect* (Norton, 1974).

January 31 Methods of Prognostication or Social Forecasting.

Read: Herman Kahn and John B. Phelps "The Economic Present and Future," *Futurist* (June 1979), pp. 202-22; Dickson, chapter 4; Brzezinski, *Between Two Ages*, Part I/chapter 1; Dickson, *Future File*, chapter 4.

Recommended: Daniel Bell, "The Year 2000 - Trajectory of an Idea" in *Daedalus* (Summer 1967) pp. 639-651.

February 5 Post-industrial Model - Bell's Society of the Future.

Read: Bell, Daniel, *The Coming of Post-Industrial Society* (Basic Books, 1973), "Introduction," 3-45; Harman, Willis W., *An Incomplete Guide to the Future* (1976), chapters 1 and 2.

Recommended: Michael Marien "The Two Visions of Post-Industrial Society," *Futures* (October 1977); 415-31; Herman Kahn and Anthony J. Wiener, *The Year 2000*, chapter 4.

February 7	Dynamics and Scope of Post-Industrial/Technetronic Society. Read: Brzezinski, *Between Two Ages*, chapters 2, 3 and 4. Recommended: Read Reviews of both Bell and Brzezinski and perhaps Kahn * List characterizations of these works--how were they perceived by reviewers?
February 12	Scenario-Building: Other Methods of Prognostication. Read: Dickson, *Future File*, chapter 5; Revisit Harman, chapter 1; Get acquainted with Delphi Technique - see Conference Board, *Perspectives for the 1970s and 1980s*. * *"The most probable scenario (of the ten) is ____________. I shall explain why in the following paragraphs":* ____________________________ Recommended: Olaf Helmer and T.J. Gordon, "Probing the Future," *News Front, The Management Trends Magazine* (April 1965).
February 14	Political or Non-Political Futures: Implications of "Technological Visions" of Bell, Brzezinski and others.
February 21	Discussion of Political Implications.
February 26	Discussion of Political Implications.
February 28	A Testing Period.
March 4	Growth Dilemmas - The Club of Rome Report. Read: Meadows, *Limits to Growth*, chapters 2, 3, 4 and 5. * Evaluate the Thesis of *Limits to Growth*.
March 6	Further Discussion of *Limits to Growth*. Read: Harman, chapters 3, 4 and 5.
March 11	Poor Countries' Point of View and Fate. Read: *A Latin American Model: Catastrophe or New Society?* (IDRC), Chapters 1, 2 and 3.
March 13	Political Implications of Third World Perspective.

March 18 Non-Technological Futures: Alernative Perspectives and New Prophets?!

Read: Theodore Roszak, *The Making of the Counter Culture* (Doubleday, Anchor Books, 1969) chapters 1, 7; also Roszak, *Where the Wasteland Ends* (1973), chapter 2 plus any one chapter of your choice.

* "Our knowing reaches out to embrace the sacred; what bars its way, though it promises us dominion, condems us to be prisoners of the empirical lie."

Recommended: Reich, Charles A., *The Greening of America* (1970); Henderson, Hazel, *Creating Alternative Futures* (1978).

March 20 Technology As If People Mattered.

Read: Harman, chapter 7; E.F. Schumacher, "Economics Should Begin With People, Not Goods," *Futurist* (December 1974): 274-275; Review of *Small Is Beautiful* and "Interview" with the author *Futurist* (Dec., 1974): 276-284.

Recommended: Schumacher, *Small is Beautiful* (1973).

March 25 Student-Teacher Conference.

March 27 Toward A Viable Future For Our Children: The Challenge of Science-Technology. The Challenge of Expectations and Values and the Promise of New Politics.

Read: Kenneth Boulding, *The Meaning of 20th Century*, chapter 9, "A Strategy for The Transition"' Harman, chapters 8 and 9; Pierre Teilhard de Chardin, *The Future of Man* (1964), chapter 15, "The Directions and Conditions of the Future"; Brzezinski, Part II, chapter 4.

* "It would be easier, at the stage of evolution we have reached, to prevent the earth from revolving than to prevent Mankind from becoming totalized."

April 1 The American Future and Global Politics: Search for New Politics?

Read: Brzezinski, *Between Two Ages*, any three chapters from Part IV and V; also Kenneth Boulding "Toward A 21st Century Politics" *Colorado Quarterly* 20 (Winter 1972): 309-19.

April 3-15 Oral Presentations.

April 17 Exam.

COURSE SYLLABUS

THE AUTOMOBILE IN AMERICA, 1890-1980:

BUSINESS, CITIES, AND POLITICS

SS 450
Fall Quarter
1980

Mark H. Rose
Dept. of Social Sciences
Michigan Technological Univ.

Work in this course will focus on the development of the automobile in the United States. Readings, lectures, and papers will develop two themes. We will examine the development of the automobile as a component in the national transportation picture, looking at the manner in which American values, the economy and business scenes, urban patterns, and politics (culture, broadly speaking), have shaped the development of transportation and the automobile in particular. At the same time, we will assess the significance of nearly unlimited automobile travel on the shaping of institutions such as the family, business, government, and so forth. Ultimately, this course is intended to highlight the roles of politics, economics, and cultural values in directing the growth of the American transportation system and the role of the automobile as well as rail and truck transport networks as they influenced the historical frameworks of contemporary American life. Let's hit the road.

Required Readings (available at the bookstore in paperback).

James J. Flink, *The Car Culture* (MIT Press, 1975).
John K. Galbraith, *New Industrial State* (3rd ed. rev., NAL, 1978).

Reserve Readings (available in the reserve section of the library).

Blaine A. Brownell, "A Symbol of Modernity: Attitudes Toward the Automobile in Southern Cities in the 1920s," *American Quarterly* 24 (March, 1972), 20-44.
Mark S. Foster, "The Model-T, the Hard Sell, and Los Angeles's Urban Growth: The Decentralization of Los Angeles During the 1920s," *Pacific Historical Review* 44 (Nov. 1975), 459-84.
Clay McShane, "Transforming the Use of Urban Space: A Look at the Revolution in Street Pavements, 1880-1924," *Journal of Urban History* 5 (May 1979), 297-307.
Mark H. Rose, *Interstate: Express Highway Politics, 1941-1956* (Lawrence, KS.: Regents Press of Kansas, 1979).

Term Paper

Each student will submit a term paper that focuses on an aspect of the automobile in historic America. I will discuss sources and topics in class, but you might begin to think about and read in one of the following areas: explain the significance of the automobile in the development of the summer and winter recreational industries in Michigan and/or nearby states, 1920-1970. The automobile industry has served as a major employer of engineers, and you might want to explore 1) the changes made in engineering education to prepare students for a place in the industry; or 2) the extent and contents of the influence of engineers in automotive design and marketing; or

3) the content and influence of engineers and engineering ideas in the organization and management of auto firms and the automotive industry. The auto has facilitated changes in the size and density of cities, perhaps contributing to the collapse of mass transit systems. Investigate the place of the auto in your home town, focusing, say, on the decentralization of retailers, manufacturers, and households. Did these changes affect transport expenses or alter chances of finding a job?

You may prepare this paper in the form of a report to the head of a public or private agency or business firm who is seeking a background on a phase of the auto industry on which he/she will make a policy choice. It is not necessary, if you use this format, to bring your research up to 1980. An outline and bibliography for the paper are due during the fourth week, and two copies of the final paper are due during the ninth.

Exams.

A quiz (20 minutes) is scheduled for the third week, and a mid-term (50 minutes) for the fifth. A final exam will be scheduled during final exam week.

Walking Tour.

Provided that the weather and our schedule cooperate, we will talk-through parking lots and along city streets, seeking to review the role of the auto in shaping the pace and patterns of historic Hancock-Houghton. Look, for instance, at the new road behind Tech, and ask what and who were there before it was built? Did "suburbs" surround Hancock-Houghton in the days of the electric trolley? What was/is the significance of the auto in the routines of Tech students? Do we learn anything about them by studying their cars?

The larger dimension underlying this exercise as well as the term paper is that I want to encourage you to review technological systems such as the automobile as expressions of social, economic, and political practices. I would also like you to join me in reviewing the role of historic engineering and business practices in the auto and other transport industries in shaping historical, social, economic, and political environments.

Class Schedule.

Week 1 Class organization; American Values and the Popularity of the Automobile.

Weeks 2-3 Travel and Transport Before the Auto.

Railraods and the bicycle "craze".
Early Days of Motoring: The Auto, the Family, and Recreation.
  The vagabond and middle-class self-perceptions.
  From campfire to motel.
  White Tower hamburgers: A middle landscape for non-motorists.

Note: Quiz, Week 3.

Week 4 Building the Automobile Industry, 1880-1925.

From Billy Durant to Alfred Sloan.
GM: Changes in marketing, finance, accounting, and organization.
Henry Ford: Industrialist and Folk Hero.

Note: Term paper outline and bibliography due.

Week 5 The Auto Industry in the National Economy.

- Technological Innovation in a Leading Sector, 1894-1930.
- The innovators in the Great Depression: New Designs and a New World.
- The innovators in World War II: Who won the war?

Note: Mid-term exam.

Week 6 Working for the Big Three.

- The line employee in 1915, 1935, and 1950.
- Competing with the Auto Industry.
  - The railroads and the ICC, 1887-1916.
  - The railroads in WWI: Coal, zones, strikes, and shortages.
  - New Deals for truckers and railroaders.

Weeks 7-8 The Auto in the City, 1900-1935.

- Early dissatisfaction with the trolley.
- The trolley and decentralization.
- Urban reform and personal reform: Moving out to the rim.
- The rearrangement of the auto city, 1900-1935.

Weeks 9-10 The Auto in the Suburbs and Central City.

- Suburbanism as a way of life.
- Buidling More Roads, 1939-1960: Highway and Auto Enthusiasts in Politics.
  - The view from the suburbs.
  - The view from the state highway department: Designing roads and political designs.
  - Presidents, economists, and the Interstate System.
- The National Transport Picture in the 1960s and 1970s.
  - Energy shortages, pollution, and urban ordering.
  - Investment, innovation, thermal inversions, and the political and social systems.

Note: Term paper due week 9.

Note: Final exam during final exam week.

Reading Schedule.

Weeks 1-3.
- Flink, pp. 1-112
- Galbraith, pp. 1-115

Weeks 4-5.
- Flink, pp. 113-233
- Rose, pp. 1-14
- Galbraith, pp. 116-196

Weeks 6-7.
- Brownell, pp. 20-44
- Foster, pp. 459-84
- McShane, pp. 279-307
- Galbraith, pp. 197-269

Weeks 8-10.
- Galbraith, pp. 270-414; optional, pp. 415-426
- Rose, pp. 55-68

Thanks for riding with me!

REVIEW ESSAY

Durbin, Paul T., editor. *A Guide to the Culture of Science, Technology, and Medicine.* New York: Macmillan Publishing Co., 1980. 723p. $45.00.

In an attempt to address the problem of fragmentation in humanistic and social science fields dealing with science, technology and medicine, contributors to this volume have provided in-depth literature reviews and bibliographies for nine disciplines. Each contributor was given three mandates: to survey the state of the art in his or her field of expertise, to link that field to others represented in the volume, and to identify values issues in the discipline. Within these constraints, authors were set free to interpret values concepts and to determine the form and scope of their literature surveys.

In his introduction, Paul Durbin describes his contributors as "playing the professor's role" in providing a guide to his or her field for colleagues in related fields. The volume is intended, then, for a specialized, scholarly readership. Disciplines covered in the volume are historical, philosophical, and sociological. Thus, certain fields that to many minds figure strongly in the "culture" of science, technology and medicine - namely literature and the arts - are not treated, except for some brief remarks in the introduction.

The three chapters on historical disciplines open the volume. Arnold Thackray's review of the history of science begins in the nineteenth century, and concludes with a description of the current diversity of scholarly approaches and "central domains" in the field, which include ancient and medieval science, the social roots of science, science and religion, and "Great Man" studies. Carroll Pursell's review of the history of technology also recognizes the eclecticism of the discipline and the variety of practitioners - archaeologists, engineers, economic and social historians. Among current and emerging areas of interest surveyed are the professionalization of engineering, medieval technology, the American system of manufactures, technology and ideology, technology assessment and women and technology. Gert Brieger's survey of the history of medicine ties the field to such disciplines as sociology, anthropology and art history. The ahistorical bias of bioethics is noted.

In his review of literature and ideas in the philosophy of science, Alex C. Michalos provides a general historical overview, a country-by-country survey of work done outside the U.S., and a longer commentary on Anglo-American analytic philosophy. Carl Mitcham follows with an overview of the development of the philosophy of technology in Western and Eastern Europe and in the U.S. His treatment of "problems" in the field is neatly divided into two parts: metaphysical issues (technology as object, knowledge, process, or volition); and ethical concerns (technology and war, work, religion, environment, etc.). The survey of the philosophy of medicine contributed by H. Tristram Engelhardt and Edward L. Erde offers a historical background, an introduction to the epistemological issues in the field, and a lengthy literature review in bioethics.

The sociological fields will perhaps benefit most from the thorough reviews of the literature of the sociologies of science, technology, and medicine contained in the volume. Jerry Gaston's survey of the sociology of science compares the Mertonian and Kuhnian models, then shifts to other literature treating sociological analysis of the scientific community and scientific growth and change. He observes that the sociology of technology "has yet to emerge as a specialized subdiscipline despite an abundance of material." The survey of medical sociology by Linda Aiken and Howard Freeman is in fact two distinct essays. The first surveys the sociology of medicine; the second reviews literature documenting the growth of science and technology in medicine and its values implications. The authors note that little has been done in medical sociology related to such scientific and technical developments.

The concluding chapter, by Diana Crane, is concerned with science and technology policy. Crane describes the multiplicity of approaches to the field and surveys the literature of science policymaking in different sectors - from agricultural R & D to social R & D - and in different nations. Values issues discussed include expertise; social responsibility of scientists, technologists, and lay people; and opposition to science and technology.

The volume as a whole bears the signs of meticulous editing and careful construction. The analytical table of contents is not only a useful finding aid, but also serves as a good outline of the fields described. References cited in the review articles appear in the lengthy bibliographies found at the end of each chapter. The bibliographies generally include an introduction; lists of archives, museums, special collections; bibliographies; dictionaries and encyclopedias; journals and sourcebooks; and 20-25 pages of selected, unannotated references. Some authors have also furnished a list of classics or indicated classic works in some special way.

The carefully crafted *Guide* should certainly take its place on the bookshelf of those teaching science, technology, and society courses. Though it does not provide a guide to the full range of STS concerns, nor to the more popular works frequently used in undergraduate courses, the review essays and bibliographies should prove an invaluable resource for interdisciplinary scholarship.

°°Christine Roysdon
Lehigh University

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

COLTON, KENT W. AND KENNETH L. KRAEMER, EDS. COMPUTERS AND BANKING: ELECTRONIC FUNDS TRANSFER SYSTEMS AND PUBLIC POLICY. NEW YORK: PLENUM PRESS, 1980. 309P. CHARTS, TABLES. $25.00.

Electronic Funds Transfer systems offer a prime opportunity for the assessment of the societal effects of a technology still in its infancy. Designed as a tool for guidance of public policy choices, the editors combine an identification of research issues with description of the existing technologies, considerations of social and economic impacts, and identification of regulatory issues. Contributors clarify the assumption that differences in scale and speed are hardly the only consequences of EFT. The potential for stratification of society, harassment, and invasion of privacy are addressed. Along with such hazards, the more optimistic outlooks in resource savings and enhancement of individual freedoms are presented. Monitoring by an impartial panel is advocated so that policy decisions can shape the effects of the technology before widespread use thwarts a flexible interaction between EFT and its environment. A fine case study with supporting data and useful emphasis on the regulatory procedure.

CONFERENCE PROCEEDINGS: WOMEN AND TECHNOLOGY: DECIDING WHAT'S APPROPRIATE. MISSOULA, MONTANA: WOMEN AND TECHNOLOGY NETWORK, 1980.

Speeches and materials from a conference held in April, 1979. Papers include: "What could appropriate technology mean for women?"; "Cultural images of women and technology;" "How the future of high technology will affect women;" and "What men studying high technology learn about women." Publication not seen. $2.50 from Women and Technology Network, 315 S. 4th St., Missoula, Montana 59801.

CORN, JOSEPH J. "MAKING FLYING 'THINKABLE': WOMEN PILOTS AND THE SELLING OF AVIATION, 1927-1940." AMERICAN QUARTERLY 31 (FALL 1979): 556-71.

In the '20s and '30s, though they constituted less than a thirtieth of all aviators, women pilots played an important and visible role in aviation. Their most significant contribution to the industry was to change the daredevil image of the aviator and allay public fears of flying. A "lady-flier" stereotype similar to the lady-driver image was circulated, indeed promoted by the aviation industry: "If 'incompetent women' could do it, the stereotype seemed to say, man-made machines must truly be fail-safe and all-forgiving." Women raced, toured, and made promotional flights underwritten by corporations. Despite such shows of aerial daring, emphasis was placed on the safety and sanity of their flights. Corn observes that women pilots, with their "aerial domesticity," "personified the era's ideal: the liberated yet feminine woman."

GOODIN, ROBERT E. "NO MORAL NUKES." ETHICS 90 (APRIL 1980): 417-49.

A survey of the nuclear power controversy focuses on new concerns generated by this issue in the areas of risk assessment, distributive justice, and democratic theory. Procedures ordinarily utilized to make social decisions about technologies are not appropriate for nuclear power because of "irresolvable uncertainties" and consequences too enormous in magnitude and extraordinary in character. Decision makers determing acceptable risks tend to ignore individual attitudes to nuclear power assuming it would be "irrational" for the society as a whole to be averse to risky ventures since the "better-than-expected performances balance out the worse-than-expected outcomes." Problems of who will have nuclear power, the disposal of waste, and the uncertainty of distant costs generate the solution of "discounting" the interests of future generations. Another aspect of the nuclear question is whether decisions will be made by a panel of experts or if public participation can occur. Goodin presents alternative methods of decision, i.e. reversibility of policy, comparison of alternatives, protection of the vulnerable, weighing the potential harms more heavily than the benefits, selection of the least unbearable policy options, opting for the policy producing the highest level of sustainable benefits.

LEAHY, PETER J. AND ALLAN MAZUR. "THE RISE AND FALL OF PUBLIC OPPOSITION IN SPECIFIC SOCIAL MOVEMENTS." SOCIAL STUDIES OF SCIENCE 10 (AUGUST 1980): 259-84.

A comparative survey of four social movements - against fluoridation, nuclear power plants, the antiballistic missile (ABM), and abortion - is reported. Using this survey, the authors test a "natural history model" designed to explain the rise and fall of public opinion in such controversies. Three chronological stages in this natural history are identified that link the growth of national concern, leadership activity, and mass media coverage. Measurements of mass media coverage encompass only magazines and not newspapers or television. Despite their efforts, the authors' model appears too simple to explain the lengthy, convoluted, and emotional histories of the abortion and nuclear power issues.

NORMAN, COLIN. MICROELECTRONICS AT WORK: PRODUCTIVITY AND JOBS IN THE WORLD ECONOMY. WORLDWATCH PAPER 39. WASHINGTON, D.C.: WORLDWATCH INSTITUTE, OCTOBER 1980. 63P. $2.00.

Recent advances in electronic technology "will have a pervasive effect on international trade, patterns of employment, communications, industrial productivity, entertainment and social relationships," the author predicts. Norman lucidly chronicles the microrevolution from patriarch ENIAC (1946), whose 18,000 vacuum tubes occupied a large room, to numerous descendants more powerful than ENIAC, yet "reduced to the size of a cornflake." The paper's chief focus is the impact of microelectronics in two areas: the automated factory and the electronic office. In the factory, minis, micros and robots may soon predominate in the labor force. In the office, word processors, facsimile machines and other devices portend even vaster changes in office work flow. While the microelectronic revolution will create jobs in industries manufacturing electronic products, these gains may be offset by job losses in factories and offices. Developing countries that currently supply cheap labor for industries such as textiles may lose their competitive advantage to the automated factory. Norman concludes that there is a need to develop policies, both national and international, to deal with technological unemployment so that the benefits of the microrevolution can be shared.

PETERS, TED. "THE FUTURE OF RELIGION IN A POST-INDUSTRIAL SOCIETY." FUTURIST 14 (OCTOBER 1980): 21-25.

Post-industrial life, as it is currently conceived, will be centered on consuming, not producing. Expression of individuality has become synonymous with consumption of distinctive goods - from new gadgets to new cars - and distinctive experiences - exotic tours, unconventional courses. Peters fears that as society evolves toward this post-industrial state, religion will become just another commodity. To some extent, the move to commoditize religion has already begun with trendy cults, television preachers, and tourist-oriented cathedrals. Next on the horizon, Peters predicts, will be canned spiritual experiences such as recreated Quaker meetings or medieval monasteries. The individual consumer, totally autonomous and free of societal restraints, will create his or her own values and interests. Such "unbridled egotism" is not consonant, Peters believes, with religion's genuine insight, the sense of the unity of all things, a commitment to a destiny that is larger than our own personal goals.

REINGOLD, NATHAN, ED. THE SCIENCES IN THE AMERICAN CONTEXT: NEW PERSPECTIVES. WASHINGTON, D.C.: SMITHSONIAN INSTITUTION PRESS, 1979. 399P. $9.95.

Though three years passed between their presentation during the Bicentennial and publication last year, these papers provide fresh and noteworthy contributions to the history of American science. William Goetzmann describes a Second Great Age of Discovery, the age of terrestrial exploration in the American wilderness and similar areas of the world which created the raw data for the theoreticians who have dominated the pages of the history of science. Bruce Sinclair explores the situation of the American scientist abroad in the antebellum period. Historical studies of individual disciplines are provided by Deborah Warner (antebellum astronomy), Steven Pyne (earth science), and Spencer R. Weart (depression era physics). Other papers examine the growth and scientific contributions of industrial research laboratories, agricultural experiment stations, and academia, as well as the vagaries of funding offered by foundations and government. Concluding papers by Carroll Pursell and Harvey M. Sapolsky cover relations between the American military and American science since World War II.

RIDKER, RONALD G. AND WILLIAM D. WATSON. TO CHOOSE A FUTURE: RESOURCE AND ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE GROWTH PATHS. BALTIMORE AND LONDON: JOHNS HOPKINS UNIVERSITY PRESS FOR RESOURCES FOR THE FUTURE, 1980. 263P. ILLUS., BIBLIOGS., TABLES. $33.50.

The assessment of the resource and environmental consequences of alternative population, economic and technological changes, trade, international relations, and nuclear policies presents a "persuasive refutation" of the "limits to growth" projections. Various possible scenarios throughout a fifty-year time horizon are developed for these variables by precise quantitative and empirical analysis utilizing computer models. These scenarios are then applied to major areas of consideration: the national economy, nonfuel minerals, energy, agriculture, pollution costs and controls, and other environmental concerns including toxic chemicals, radiation, climate, water and land resources. A base case is identified for each of these major areas and it is accompanied by comparison for alternative possible developments. Valuable for its methodology of dissagregate analysis and specificity of data. The statistics provided for mineral resources including exhaustion dates and the plotting of nuclear power plant sites are especially useful. Some of the backbone assumptions may be problematic: the forecasts for oil prices based on 1975 data, the consensus that technology will continue to change in evolutionary ways, and the reliance on the general continuity of present U.S. policies toward the environment and nuclear power. Most surprising to the non-specialist is the prognosis of a phase-out of nuclear power sources after 2020. Description of the computer model is provided in an appendix. The computer tapes are available from Resources for the Future. Essential for all futures researchers.

RIFKIN, JEREMY, WITH TED HOWARD. ENTROPY: A NEW WORLD VIEW. NEW YORK: THE VIKING PRESS, 1980. 305 P. $11.95.

In a popular book that has received a lot of press hype, Jeremy Rifkin interprets current social ills and adaptation problems as symptoms of the inevitable process of entropy. Though unstoppable, entropy growth has been hastened by the wasteful use of resources encouraged by our ideology of progress. In the fulminating prose that characterizes the book, Rifkin suggests that ours is a world view that is "diseased and dying and contaminating everything it gave birth to." Western science has recognized the universal governance of the second law of thermodynamics, which in Rifkin's words states: "...matter and energy can only be changed in one direction, from usable to unusable, or from available to unavailable, or from ordered to disordered." Ironically, the author claims, we expect human history to follow the opposite course - moving from chaos to an orderly, precise, machine-like progression. The somber truth of the universality of the entropy process should not bring despair, Rifkin suggests, but should, rather, stimulate humankind to adjust to the ultimate physical and temporal confines of the planet, through such measures as eliminating energy waste in transportation, weapons, urban life, and health care. The author advises a redistribution of wealth, spartan life style, solar power, and a new religion of stewardship.

STERN, MICHAEL. "MAKING CULTURE INTO NATURE: OR WHO PUT THE 'SPECIAL' INTO 'SPECIAL EFFECTS'?" SCIENCE-FICTION STUDIES 7 (NOVEMBER 1980): 263-67.

Innocuous in appearance, but deceptive, special effects in science fiction films "accomplish the political work of legitimizing current structures of domination," Stern contends. The promise and terror of new technologies from space stations to future weapons are observed by the movie audience, but are only incidental to the plot. Future technologies are thus subliminally presented as inevitable magic to which people must conform.

Christine Roysdon
Lehigh University Libraries

Judith Mistichelli
Library of Congress

BIBLIOGRAPHICAL GUIDE

Cutcliffe, Stephen H.; Mistichelli, Judith A.; and Roysdon, Christine M., eds. *Technology and Values in American Civilization: A Guide to Information Sources.* Vol. 9. American Studies Information Guide Series. Detroit: Gale Research Company, 1980. 704 p. Indexes. $30.00.

Technology and Values in American Civilization is an interdisciplinary bibliographical guide including over 2400 annotations just published by Gale Research Co. of Detroit. The following excerpts from the volume's introduction offer a brief summary of its scope and contents.

The view of technology as an intrinsically human activity has been increasingly recognized and voiced in recent decades. Professionals in diverse fields, including engineering, the sciences, medicine, law, business, and teaching, find that an awareness and comprehension of the social and environmental impacts of new as well as existing technologies are necessary to their pursuits. Invention proceeds in the "post-industrial age" at a pace well beyond an individual's capacity to grasp its implications. A guide to materials documenting not only the manner in which American values have molded attitudes toward technology, but also technology's effect on the formation of values will assist in the development of a many-faceted perspective on the role of technology in American culture.

Those investigating the interaction between technology and man are faced with a burgeoning output of research and comment which appears in a wide range of journals, monographs, and other materials. Scholars lament the existing gaps in specific areas, yet the aggregate sum of relevant publications is staggering. The diffuse nature of the field transcends the developed expertise of most inquirers. Our educational system of academic and professional specialty leaves scholars at a distinct disadvantage when approaching such cross-disciplinary study or attempting a holistic understanding of our society.

The present guide to information relating technology and values in America is designed with a threefold purpose: to provide a basis for undertaking investigations of the scholarship in various disciplines which impinges on the effects of advancing technology on civilization; to steer the user, through selectivity and annotations, to the most significant statements resulting from considerations of technology from the perspectives of social or humanistic values; and to furnish an extensive initial source for the researcher in need of information or commentary on specific topics in the field.

The guide has been developed to assist not only teachers, researchers, and students on the collegiate level, but also participants in and administrators of programs integrating technology, science, and society, as well as professionals and managers involved with confrontations between technology and man.

The breadth of the topic, and the immense number of potential entries, required that we be highly selective, both in terms of quality and of subject. Scholarly materials received preference over popular selections, though influential works of the latter category are well represented. Technology, rather than science, is the object of concern, so that works that treat only the history of science, science policy, or philosophy of science, to name three areas, have not been included. Among works treating the technological enterprise, only those were sought in which human values are discussed, explicitly or implicitly.

Separate topical chapters cover works from various disciplines that discuss the interaction of man and technology, including: History...Industrialization... Labor and the work process...Economics of technology...Urbanization...Sociology and psychology...Education...Technology policy...Transportation...Communications...Environment...Energy...Appropriate technology...Philosophy and ethics... Literature...Art...Architecture...Music...Futures.

The authors have striven to maintain a neutral or impartial stance toward technology. Attempts have been made to provide a balance of statements expressing various viewpoints for both specific issues and general attitudes. Documentation of the changes in attitude toward technology over the course of American industrialization and technological development is also provided through the inclusion of publications spanning the period from the late nineteenth century to the present. The necessary emphasis on materials produced in the last two decades results from the mushrooming of considerations of the value implications of technology during that era. It must be recognized that the original faith in rationality and utilitarianism has waned in recent times. Questioning of technology's impact on man and his habitat, futuristic views, and sensitive statements of doubt, all of which have recently received credence, dominate the contemporary literature.

Technology and Values in American Civilization is available directly from Gale Research Co., Book Tower, Detroit, Michigan 48226 (313-961-2242) for $30.00 in hardcover. SHC

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Preliminary Notice

of a Conference on the Fundamentals of Engineering in a Liberal Education

Lehigh University will host a two-day national *Conference on the Fundamentals of Engineering in a Liberal Education* in mid-May 1981. This Conference, under the direction of Dr. Adrian Richards, has been endorsed by the Council for the Understanding of Technology in Human Affairs (CUTHA). The Conference objectives are to have distinguished engineering authorities present invited overviews on six subjects basic to engineering that should be known by any liberally educated person and to provide an opportunity for other engineers to present contributed papers on these subjects. An invited paper on technology as culture, emphasizing the role of technology in a modern society, will set the stage for the six papers on decision analysis, systems engineering, planning and design, risk analysis, optimization and cost-benefit analysis, and modeling theory and practice. Each speaker is expected to be very sensitive to the fact that many, if not most, non-science/engineering majors are more comfortable with qualitative rather than quantitative concepts and knowledge. While the Conference will focus on the development by engineers of resource materials for undergraduate courses, teachers in the liberal arts, business, law, and others are welcome to attend. An announcement giving details of the Conference will be distributed early in 1981. This Newsletter will report on further details as they become available.

OPEN FORUM

INTERFACE '81

The Department of English and History of Southern Technical Institute, a four-year college of engineering technology, is sponsoring, in conjunction with the Humanities and Technology Association, the fifth annual conference on the interface of the humanities and technology in Marietta, Georgia (metro Atlanta), October 22-23, 1981.

Papers and presentations in the growing discipline that examines the integration of humanistic concerns and technological growth are invited. To focus fully on this interaction, submissions should contemplate the following areas:

-- Relation of the humanities and technology as perceived by business and industry.
-- Ramifications of technology in medical ethics.
-- History and philosophy of science, technology, and architecture.
-- Public policy and understanding of science and technology.
-- Curriculum design for the humanities and technology.
-- Roles and effects of technology in science fiction, American studies, and popular culture.
-- Responses of literature, aesthetics, and the arts to technology.

The deadline for submissions is May 1, 1981.

Abstracts and/or papers should be addressed to: Amos St. Germain or Carol M. Barnum, Department of English and History, Southern Technical Institute, Marietta, Georgia 30060.

* *

THE TECHNOLOGY AND SOCIETY DIVISION

of the American Society of Mechanical Engineers is soliciting papers on the following topics for presentation at the Winter Annual Meeting in Washington, D.C., November 15-21, 1981. Two copies of the abstract (200-500 words) or completed manuscript of the paper may be submitted to: Prof. A. M. Dhanak, Department of Mechanical Engineering, Michigan State University, East Lansing, Michigan 48824. The deadline for the abstracts: February 28, 1981.

Papers on the following topics will be considered to be especially suitable: (1) Technology assessment - analysis, forecasting, social impacts, ethical values, methodologies; (2) Energy assessments; (3) Assessment of solar energy and of other alternate energy sources; (4) Environmental assessments; (5) Analysis and/or proposed models of engineering ethics; (6) Assessment of emerging technologies; (7) General aspects dealing with interactions between technology and society; (8) Case studies of technology assessment.

Submitted abstracts or papers will be reviewed as to their appropriateness for the planned sessions and the authors will be notified of the acceptance of the papers for preprint publications and presentations by April 1.

STS RESEARCH FELLOWSHIPS

The MIT Program in Science, Technology, and Society, with the support of the Exxon Education Foundation, invites applications for several one-year research fellowships on the relationships of science, technology, and society. Selection criteria include:

-- a record of outstanding performance in a particular field of science, engineering, social science, or the humanities;
-- evidence of a commitment to research involving the interaction of science, medicine, or engineering with society;
-- a proposal of study and research for the fellowship year related to the Program's areas of research and teaching, which include:

Social and Historical Studies of Science and Technology.
Technology and the Political Economy of Industrial Societies.
Cultural Dimensions (e.g., ideological, aesthetic, ethical) of Science and Technology.
Policy Studies involving Science and Technology.

Application should be made in a letter consisting of no more than five double-spaced typed pages and a curriculum vitae. Additional material will be requested if necessary. PhD degree or equivalent desirable. PhD's at all levels of professional career and foreign nationals are eligible. Partial or full stipend available, normally not exceeding $25,000. Stipend based on current salary. Senior candidates are encouraged to supplement stipends with other funds. Appointments will commence in September 1981. Address application to: Prof. Loren Graham, STS Program, Room 20D-213, Massachusetts Institute of Technology, Cambridge, MA 02139. Deadline for receipt of applications: January 15, 1981.

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SCIENCE, TECHNOLOGY, AND HUMAN VALUES SEMINARS

WASHINGTON, D.C. -- The National Endowment for the Humanities (NEH) recently announced the 1981 schedule and application deadline for the Agency-sponsored Summer Seminars for Teachers Program that annually supports approximately 115 eight-week sessions nationwide for some 1400 college teachers. The summer program is offered to two-year, four-year, and five-year college and university teachers to provide advanced study and research opportunities in the teachers' own fields or in fields related to their interests. Each of the seminars accommodates 12 teachers. Participants receive a stipend of $2,500 for travel to and from the seminar site, and for research and living expenses. The sessions, held at institutions which have major libraries suitable for advanced research work, are directed by distinguished scholars whose academic interests coincide with the seminar topic. Eligible applicants must be full- or part-time teachers at private or state undergraduate institutions, or at junior or community colleges. The 1981 NEH Summer Seminar brochure listing seminar topics, dates, locations, and directors may be obtained in January, 1981, from department chairpersons at higher education institutions across the country. Teachers interested in applying to a seminar should write directly to the director for detailed information and for application materials. The deadline for submitting applications to directors will be April 1, 1981. Several seminars are particularly related to STS topics.

Director/Location	Topic	Director/Location	Topic
James F. Childress Dept. of Religious Studies University of Virginia Charlottesville, VA 22903	*Principles and Metaphors in Biomedical Ethics* June 15-August 7, 1981	Eugene S. Ferguson Dept. of History University of Delaware Newark, DE 19711	*Engineers and Conflicts: An Historical Analysis* June 15-August 7, 1981
Martin J. Klein Dept. of History c/o NEH Summer Seminars Box 2145, Yale Station New Haven, CT 06520	*Physicists in Historical Context* June 15-August 7, 1981	William H. Sewell, Jr. Dept. of History University of Arizona Tucson, AZ 85721	*Labor and the Industrial Revolution in Europe and America.* Seminar Location: Institute for Advanced Study, Princeton

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